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Notes of the Month

COTTON: PROGRESS AND PROSPECTS

POINTING out that is looks as though the expansion in total world production of cotton textiles has come to a halt for the time being, the latest statistical review by the Cotton Board states that the output of cotton yarn in the third quarter of 1960 in those non-Communist countries for which figures are available was about 1% higher than in the same period in 1959. In the U.S. cotton yarn output in the third quarter was substantially less than a year earlier. Yarn output in the U.K. and Canada was also less; in the former it was more through shortage of labour than orders. World trade in cotton piece goods continued at a very high level. Exports from non-Communist countries were about 8% greater than in the corresponding period of last year. This compared with a 19% increase in the first six months of the year. Compared with a year earlier exports from Japan, Hong Kong, Pakistan and almost all the European countries showed increases in the third quarter. In contrast shipments from the U.K., the U.S.A. and, in particular, India were smaller. Exports of man-made fibre piece goods from non-Communist countries in the first half of 1960 were about 4% less than in the same period of 1959. However, there was a measure of recovery in the third quarter, when exports were about the same as a year earlier. The volume of Japanese exports exceeded the figure for the corresponding quarter of the previous year for the first time for over two years. Exports from all the other main exporting countries except Italy were less than in the third quarter of 1959.

In the U.K. cotton industry yarn output in November was the best for any month with the exception of May, but was still about 4% less than the level achieved in October 1959, which was the post-recession peak. Output of pure cotton yarns is now much the same as it was in May, but there has been a slight decline in the production of waste yarns and a more substantial decline in the output of spun man-made fibre yarns, particularly in the very coarse counts for the tufted carpet and similar trades. The latest figures for weaving relate to October when the rate of output was the best for any month since January, though still about 5% less than in October 1959. The general picture is of the level of production being held back only by a shortage of labour. An exception is the doubling section, where some short-time is being worked. Here the heavy imports of doubled yarn are a major depressing factor. In the first four weeks of November doubled yarn output (in terms of weight) was running about 9% below the May level.

There has been an encouraging improvement in output per head since the reorganisation schemes took effect. The best pre-reorganisation period to take for purposes of comparison is June 1959. Since then output per head in spinning has gone up by over 10%, an increase which can be accounted for only to a minor extent by the slight coarsening in the average count spun. In the case of weaving valid comparisons can be drawn only for the Lancashire area. There output per head has increased by nearly 7% since June 1959.

There was a flurry of buying at the beginning of October, prompted in part by the claim for shorter hours. Since then the rate of ordering has been much slower, though in general mills order books remain very long and deliveries have been well maintained. Retail sales of clothing remained excellent throughout the summer and autumn, a possible favourable influence being the diversion of money from goods affected by hire purchase restrictions. In the first ten months of the year sales of clothing were about 8% greater than in the corresponding period of 1959 after allowing for price changes. However, preliminary reports of retail sales in November are less favourable, and if the economy as a whole moves into recession, accompanied probably by an easing of hire-purchase restrictions, retail sales cannot be relied on to remain a buoyant factor in the textile situation. The difficulties of the motor industry have already led to some reduction in the offtake of textiles used in that industry, and there has almost certainly been a considerable rebuilding of stocks of many types of cloth in the pipeline. On the other hand any reduction in the standard working week would certainly reduce the level of production, at least temporarily.

There was little change in the total volume of imports of cotton piece goods in the third quarter of 1960, but Portugal, the U.S.A. and Canada became more prominent as supplying countries. Of all the cotton piece goods imported from countries other than India, Pakistan and Hong Kong in the first nine months of this year roughly one-third consisted of finished cloth, in which the Commonwealth countries have not been very interested until very recently, and another third consisted of grey cloth imported for processing and re-export, a trade which is open to Commonwealth countries without restriction. The remaining third consisted of grey cloth intended for consumption in the U.K., and of this almost half came from Spain. About three-quarters of all grey cloth imported for home consumption in the first nine months of the year came from India, Pakistan and Hong Kong. It would appear that there is an element of subsidy or dumping or both in the case of imports from Spain, and in the limited case of corduroy the Board of Trade has given notice that they are considering an application for the imposition, under the Customs Duties (Dumping and Subsidies) Act 1957, of an anti-dumping or countervailing duty on imports from Spain. Imports of cotton yarn, mainly from Spain and India, and of man-made fibre piece goods, mainly from the U.S.A., Germany and Italy, also continued at a very high level in the third quarter.

Exports of cotton piece goods totalled only 74 million sq. yds. in the third quarter, compared with 85 million in the second quarter and 83 million in the third quarter of

last year. The only considerable increases compared with a year earlier were in shipments to British West Africa and the Irish Republic. In contrast there were marked decreases in exports to Rhodesia and Nyasaland, Australia, the Congo, French Africa, Burma and the U.S.A.

THE GRADUATED PENSION SCHEME

THE National Insurance graduated pension scheme comes into operation at the beginning of April when employees not contracted out of the scheme and whose earnings exceed £9 a week will start to pay graduated contributions for retirement pensions related to their earnings. Graduated contributions, to be collected through the Inland Revenue P.A.Y.E. system, will be paid in addition to flat rate contributions, which will continue to be paid as at present—usually by stamping a national insurance card. The employee's share of the flat rate contribution for those not contracted out will be practically the same as at present; it will be 9s. 9d. (8s. 0d. for women), making a total contribution, including the employer's share, of 18s. 2d. (15s. 2d. for women). This flat rate contribution counts for all flat-rate national insurance benefits. From the first week in April the flat rate retirement pension, widow's pension and sickness and unemployment benefits will be increased from 50s. to 57s. 6d. a week (from 80s. 0d. to 92s. 6d. a week for a married couple).

The graduated part of the scheme applies to all employees who come within the ordinary P.A.Y.E. income tax arrangements (whether or not they actually pay tax). It will not apply to "self-employed" and "non-employed" people, to employees under 18, or to those drawing their retirement pension. A graduated contribution in addition to the flat rate contribution will be paid in any tax week where gross pay for income tax purposes exceeds £9. The employee will pay approximately 4¼% of that part of his pay between £9 and £15. This graduated contribution will range from a penny a week for those earning just over £9, to 5s. 1d. a week on earnings of £15 or more. The employer pays exactly the same amount as the employee. The tables show how the scheme will work for people of various ages in April and with different levels of earnings. Details of the amount of graduated contributions paid by each employee will be entered by the employer on the P.A.Y.E. deduction cards and these particulars will be recorded in the employee's personal account at the Ministry's Central Record Office at Newcastle-upon-Tyne.

The graduated contributions paid by the employee will accumulate into units of £7 10s. for men and £9 for women, each unit buying sixpence a week of graduated retirement pension. (The higher unit for women is mainly because of their earlier pension age.) Any outstanding contributions amounting to half a unit or more will be rounded up to provide an extra 6d. a week of pension. A widow will get one half of any graduated pension her husband had earned when he died added to her retirement pension. Employed married women and widows will still be able, as at present, to choose whether or not to pay the flat rate contribution. But, unless they are contracted out, they will have to pay a graduated contribution in any week in which their pay exceeds £9. They will receive graduated pension based on the number of £9 graduated contribution units paid, in addition to any other pension they become entitled to on their own or their husband's insurance.

Employees Contracted Out.—Employees who have retirement pension rights in an occupational scheme which satisfies certain conditions can be contracted out of the graduated part of the National Insurance scheme. Those employees who are to be contracted out will be told by their employers. Up to date 1,900,000 men and 400,000 women —a total of 2,300,000—have been contracted out. At the beginning of April the weekly contribution rates for employees contracted out will be 11s. 4d. (8s. 10d. for women), and the total including the employer's share 21s. 0d. (16s. 5d. for women). These contributions count for all flat-rate national insurance benefits, including the flat-rate retirement pension at the higher rates payable from April.

Graduated Contributions and Pensions

MEN

Level of Weekly Earnings	Weekly Contributions		Age at Entry	Total Weekly Retirement Pension at 65	
	Employee	Employer		SINGLE	MARRIED
£9 or less	9s. 9d.	8s. 5d.	—	£2 17s. 6d.	£4 12s. 6d.
£10	10s. 8d.	9s. 4d.	30	£3 3s. 0d.	£4 18s. 0d.
£12	12s. 5d.	11s. 1d.	42	£3 8s. 0d.	£5 3s. 0d.
£14	14s. 1d.	12s. 9d.	50	£3 9s. 0d.	£5 4s. 0d.
£15	14s. 10d.	13s. 6d.	57	£3 4s. 6d.	£4 19s. 6d.

WOMEN

Level of Weekly Earnings	Weekly Contributions		Age at Entry	Total Weekly Retirement Pension at 60
	Employee	Employer		
£9 or less	8s. 0d.	7s. 2d.	—	£2 17s. 6d.
£10	8s. 11d.	8s. 1d.	30	£3 1s. 6d.
£12	10s. 8d.	9s. 10d.	40	£3 5s. 0d.
£15	13s. 1d.	12s. 3d.	54	£3 2s. 0d.

MAN-MADE FIBRE PRODUCTION

PRODUCTION of man-made fibres in 1960 reached the record total of 591·99 mn. lb. according to figures issued by the British Man-made Fibres Federation. This is an advance of 78 mn. lb., or some 15%, on the previous year—1959—also a record year, when total production was 513·89 mn. lb., and compares with 421·51 mn. lb. in 1958, and 495·14 mn. lb. in 1957. The breakdown of these figures into filament yarn and staple fibre also shows clear records for both types, continuous filament yarn totalling 268·61 mn. lb. in 1960, compared with 234·83 mn. lb. in 1959 and 190·86 mn. lb. in 1958. Staple production in 1960 totalled 323·38 mn. lb., compared with 279·06 mn. lb. in 1959 and 230·65 mn. lb. in 1958. While nylon, "Terylene," acetate and the acrylic fibres all contributed to the expansion, viscose rayon production continued to dominate the position, filament and staple together accounting for about 75% of total production.

There was some reduction in output in December, compared with November, and for the first time in 1960, production was not a record for the month concerned. The total at 47·10 mn. lb., which included some reduction in output due to Christmas holidays and shut downs for maintenance after the busiest year in history, compared with 51·00 mn. lb. in November, 50·79 mn. lb. in December 1959, but only 40·14 mn. lb. in December 1958. Of this total, 21·53 mn. lb. was filament yarn, compared with 23·37 mn. lb. in November and 22·87 mn. lb. in December 1959. Staple, at 25·57 mn. lb., compared with 27·63 mn. lb. in November and 27·92 mn. lb. in December 1959. One influence on staple output was some cutback in production intended for the tufted carpet trade, which a year ago was buying on an almost panic scale through unjustified fears of shortages. At the moment there are signs of a revival in this trade, which appears to have been affected by the credit squeeze.

		Million lb. C.F. Yarn (Singles)	Staple	Total
1959	(quarterly average) ..	58·71	69·77	128·48
1960	(quarterly average) ..	67·15	80·85	148·00
1959	1st quarter	55·51	67·96	123·47
	4th quarter	65·81	79·33	145·14
1960	1st quarter	68·29	87·43	155·72
	4th quarter	68·04	80·27	148·31
1959	October	21·75	25·40	47·15
	November	21·19	26·01	47·20
	December	22·87	27·92	50·79
1960	October	23·14	27·07	50·21
	November	23·37	27·63	51·00
	December	21·53	25·57	47·10

Acrylic Fibres: Properties and Uses*

Properties and count limits of "Courtelle" on the flax, cotton, spun silk, woollen and worsted spinning systems. Other points dealt with include high bulk yarns, factors in woven and knitted fabric constructions, dyeing, printing and finishing techniques, also information on the ever widening variety of end uses.

By N. JACKSON†

FIBRES consisting of a minimum of 85% acrylonitrile are usually said to be "acrylic fibres." Certain fibres containing less than this percentage are referred to as "modified acrylics." The acrylic fibres as a family can be said to have medium high strength little changed when wet, good extensibility-at-break, low moisture absorption, low water imbibition, good though not outstanding abrasion resistance and a very marked degree of plasticity in water at temperatures near to the boil. Though of the same family the different types differ in most respects to some degree. Considering the acrylic fibres available in this country:—

"Orlon 42"—dyes with basic and dispersed dyes, cross section is dog bone shaped, colour fairly white.

"Acrilan"—dyes with acid dyes, cross section circular, colour creamy.

"Courtelle"—dyes with basic and dispersed dyes, cross section circular, colour creamy white.

Table 1. Availability of "Courtelle"

It is produced in both standard matt and bright forms. "Courtelle" staple is available in the following deniers and staple lengths:—

Fil. Den.	Staple Length (in.)
2	$1\frac{7}{16}$, 2
3	$1\frac{7}{16}$, 2, $2\frac{1}{2}$, 4, 6
$4\frac{1}{2}$	$1\frac{7}{16}$, 2, $2\frac{1}{2}$, 4, 6
6	$2\frac{1}{2}$, 4, 6
9	$2\frac{1}{2}$, 4, 6
15	$2\frac{1}{2}$, 4, 6

"Courtelle" is also available in tow form.

Fil. Den.	Total Den.
2	480,000
3	480,000
$4\frac{1}{2}$	450,000*
6	480,000
9	450,000

* It is planned to increase this to 480,000 but the change has not yet come into operation.

The crimp in "Courtelle" staple is appropriate to the denier and staple length. "Courtelle" tow is supplied with crimp and finish suitable for the various tow-to-top conversion systems.

Table 2. Count Limits on Various Spinning Systems

	Flyer Spinning 3½" pitch	Ring Spinning
FLAX SYSTEM		
3 den. 6"	60's linen lea	110's linen lea
4½ den. 6"	45's linen lea	60's linen lea
6 den. 6"	18's linen lea	36's linen lea

Den.	Staple Length	
COTTON SYSTEM		
2·0	$1\frac{7}{16}$"	36's c.c.
3·0	$1\frac{7}{8}$"	16's c.c.
3·0	$2\frac{1}{2}$"	20's c.c.
4·5	$2\frac{1}{2}$"	10's c.c.
67% 2 den.	$1\frac{7}{16}$" "Courtelle"	36's c.c.
33% 1½ den.	1⅞" matt "Fibro"	
65% 3 den.	$2\frac{1}{2}$" "Courtelle"	20's c.c.
35% 3 den.	$2\frac{1}{2}$" matt "Fibro"	

SPUN SILK SYSTEM (using Halle Seydel tow)	
2 den.	60's c.c.
3 den.	40's c.c.
WOOLLEN SYSTEM	
2 den. 2"	56's Y.S.W.
3 den. $2\frac{1}{2}$"	44's Y.S.W.
$4\frac{1}{2}$ den. $2\frac{1}{2}$"	35's Y.S.W.
9 den. $2\frac{1}{2}$"	24's Y.S.W.
9 den. 4"	28's Y.S.W.
WORSTED SYSTEM	
3 den. 4"	64's w.c.
4½ den. 6"	44's w.c.
50% 3 den. 4" "Courtelle" / 50% 64's wool	60's w.c.
50% 4½ den. 6" "Courtelle" / 50% 56's wool	46's w.c.

Even where the fibres dye with the same general types of dyestuffs, dyeing rates differ noticeably and there are sufficient differences between the fibres to make it unwise to make a straight substitution of one fibre for the other without experiment or guidance from the fibre producers.

"Courtelle" is primarily acrylonitrile combined with other minor constituents. Produced in staple fibre form in a range of deniers from 2 to 15 and in staple lengths of $1\frac{7}{16}$ to 6 ins. It is suitable for conversion on most yarn spinning systems either alone or in blend with other fibres. (Full details of the denier, staple length and tows available are given in Table 1). Fibre is also produced in tow form for conversion into sliver by the various tow-to-top machines, some involving stretch breaking, others by cutting. "Courtelle" is not produced as a continuous filament yarn.

Spinning Systems and Count Limits

These are given in Table 2 and should be taken as a guide rather than absolute standards for the obvious reason that skill varies between mills and when more experience is acquired these limits may be exceeded.

Table 3 shows the properties of "Courtelle" in comparison with other fibres. The main point is medium high strength little changed when wet. This means that in constructing most fabrics little thought has to be given to the strength factor, for most fabrics which can be woven or knitted, and having reasonable appearance, handle, seam slippage, drape etc., will have adequate strength for the purpose required. Extension-at-break is quite high and approximately the same in both wet and dry states. The fibre has a low density, hence giving good bulk, low moisture regain and low water imbibition. The latter properties impart to fabrics made from "Courtelle" a warm touch and quick drying properties after washing.

Fig. 1 shows the cross section of "Courtelle" in comparison with "Acrilan," "Orlon," nylon, acetate and wool. Fig. 2 gives load/extension curves for "Courtelle," nylon, viscose rayon and wool. Fig. 3 gives the load/extension curves for "Courtelle" at different temperatures. It will be seen from this series of curves how easily "Courtelle" can be stretched in water at temperatures approaching the boil.

Table 3. Properties of "Courtelle" Compared with Other Fibres

	Tenacity, Grams/Den.		Extensibility, %		Density	Moisture Regain % at 65% R.H., 68°F.	Water Imbibition % (1,000 G.)
	Dry	Wet	Dry	Wet			
"Courtelle" Staple	3·0 - 3·6	2·3 - 2·7	40 - 45%	40 - 45%	1·15	2·0	8%
Wool	1·0 - 1·7	0·8 - 1·6	25 - 35%	25 - 50%	1·32	15	40%
Cotton	3·0 - 4·9	3·3 - 5·4	5 - 10%	5 - 10%	1·54	8	45%
Viscose Staple Standard	2·2 - 2·6	1·2 - 1·5	18 - 30%	20 - 40%	1·53	11 - 13	90%
Viscose Staple Strong	3·3 - 3·7	2·2 - 2·6	19 - 22%	22 - 26%			
Acetate Staple	1·1 - 1·3	0·7 - 0·8	30 - 35%	40 - 45%	1·32	6·5	35%
Nylon Staple	4·1 - 4·5	3·6 - 4·0	37 - 40%	42 - 46%	1·14	4	13%
Polyester Staple	3·5 - 4·0	3·5 - 4·0	25 - 40%	25 - 40%	1·38	0·4	3%

* *From a paper given recently to Bradford Textile Society.*

† *Courtelle Dept., Courtaulds Ltd., Coventry*

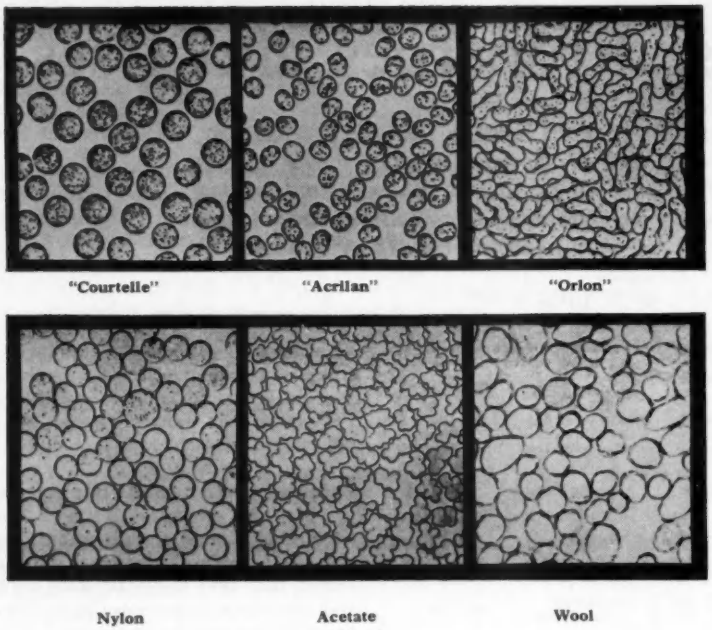


Fig. 1.

This a point which must be bourne in mind when handling "Courtelle" in dye liquors, scouring liquors, and the like. Tension should be kept to a minimum and the baths should be cooled slowly. Tensions and temperatures in stentering should be kept to a minimum consistent with economical running.

Fig. 4 shows the resistance of "Courtelle" to acids and alkalis at 60°C. Fig. 5 the resistance of "Courtelle" to sunlight exposure and effect on breaking load.

Flammability—For fire insurance purposes the fibre is Class 1. (Fire Officer's Committee Rating).

Handle—In the absence of any finishing agent the fibre has a dry handle.

High Bulk Yarns

"Courtelle" has a low density—1·15 to 1·17— which in itself gives bulkiness compared with most other non-acrylic fibres; where however really bulky yarns are required, such as for knitwear, high bulk yarns are used. No matter how high bulk yarn is produced the underlying principle is the same, i.e. that at the time the yarn is spun some of the fibres are in a highly stretched condition, and other fibres are in a relaxed condition. The resulting yarn spun from such a blend has the property that when it is placed either in steam or entered into boiling water free from restraint the highly stretched fibres contract and the relaxed fibres buckle-up to increase the yarn diameter and therefore the bulkiness. The result of this principle of making high bulk yarn is to give a yarn of particular count which has a diameter of a count very much coarser.

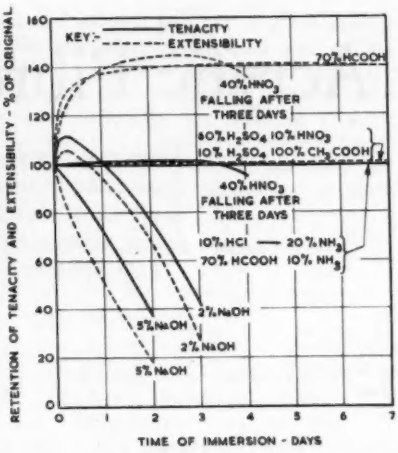


Fig. 4. Resistance of "Courtelle" to acids and alkalis

Example:—If a yarn is spun from a blend of 60% 3 den. relaxed "Courtelle" and 40% 3 den. highly stretched "Courtelle," and supposing the count is 2/28's w.c., such a yarn after steam relaxing would contract about 18% giving a count of 2/23's in the relaxed condition. The bulkiness of this yarn, however, would be

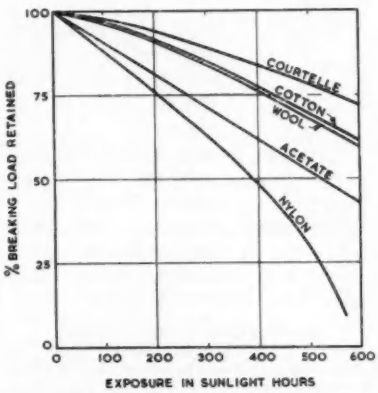
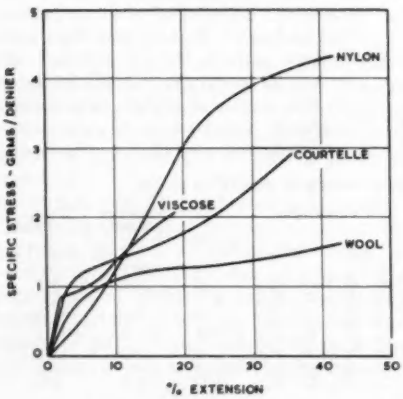
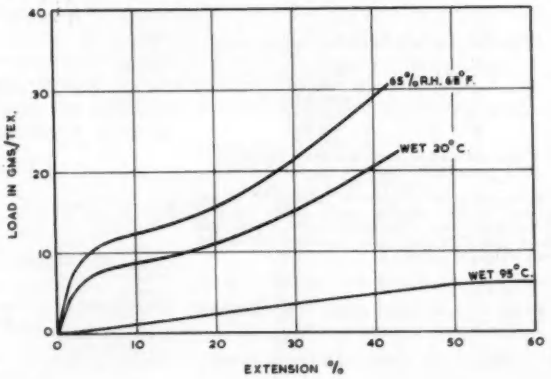


Fig. 5. Resistance of "Courtelle" to sunlight exposure



(left) Fig. 2. Load/extension curves for "Courtelle," nylon, viscose rayon and wool

(right) Fig. 3. Load/extension curves for "Courtelle" at different temperatures



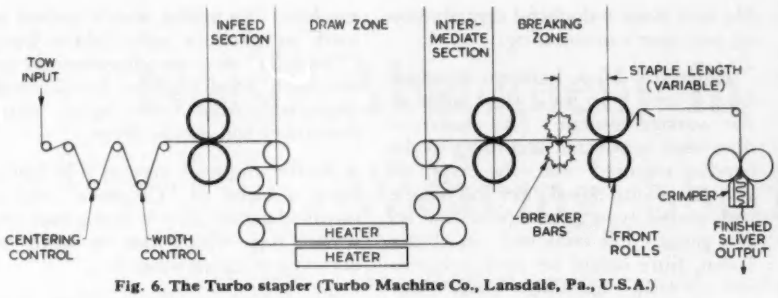


Fig. 6. The Turbo stapler (Turbo Machine Co., Lansdale, Pa., U.S.A.)

equal to that of about 2/18's of an ordinary standard "Courtelle" yarn, i.e. not a high bulk yarn. It will readily be seen that this makes it possible to produce garments which have bulkiness with apparently little weight, and when the general principles underlying the warmth of a fabric are taken into consideration, it will be realised that fabrics made from high bulk yarn are warm to the touch and to wear. So much for general principles.

The most used commercially and the one producing the best high bulk knitting yarn is undoubtedly the yarn produced by the Turbo Stapler (Fig. 6). The tow enters as a broad ribbon at one end and passes through a heat stretching zone, where it is stretched approximately 40% in length. The tow cools and enters a further stretching zone where the fibres are stretched to the break. The maximum length of the fibre broken is controlled by the position of the beater bars. The broken fibre in sliver form now passes forward to the crimping box to give it some cohesion and is coiled into metal cans with louvres in the sides.

The sliver, after Turbo Stapling, contains fibres of a variable length, but all the fibres are in a highly stretched condition. Therefore, in order to produce a high bulk yarn it is necessary to steam relax approximately 60% before blending with 40% which has not been relaxed, and so produce a high bulk blend.

It is to assist in this steam relaxing that metal cans with louvres down the side are used, and these are placed in vacuum/steam chambers and steamed under slight pressure. The steam relaxed and the unrelaxed slivers are now blended together in the proportions of 60:40 and spun on a modified worsted system.

Fig. 7 (top) shows the yarn produced via the Turbo Stapler and spun on the worsted system, as it appears immediately after spinning, and in the lower portion is seen the same yarn which has been steam relaxed and bulking has taken place.

Silk System Bulk Yarns

It is usual to stretch-break a tow to produce a sliver for spinning on silk machinery. This is best achieved by using a Seydel converter. The fibres in the stretch-broken sliver have a potential shrinkage in boiling water of about 12% and if spun into a yarn without first steam relaxing would give a yarn contraction in boiling water of about 10 to 11% with negligible increase in bulk. If, however, 60%

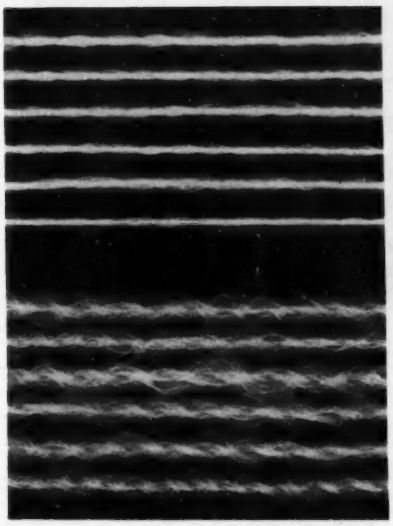


Fig. 7 Before and after bulking

of the fibres are steam relaxed in sliver form and blended with 40% of the unrelaxed material, such a yarn would shrink about 10% and give a certain degree of bulking, though not so great as that of the Turbo high bulk yarns mentioned previously. Where fine yarns are required in a compact structure, the use of unrelaxed silk spun yarns means that ends and picks per inch in loom can be reduced and the fabric density required achieved during finishing.

Woollen Spun H.B. Yarns

When it is required to produce fabrics to simulate milling, this can be achieved by using woollen spun yarns produced from a blend of standard and high shrinkage staple, such fabrics may require slight raising either before or after contracting Contracting consists of treating the fabric in a relaxed condition at open width in boiling water followed by cooling before subjecting the fabric to strain.

Blending with Other Fibres—"Courtelle" can be readily blended with other fibres such as cotton, wool, viscose, "Tricel" etc. but to obtain the benefits of "Courtelle" in the nature of washing stability, warmth, quick-drying, crease resistance and pleatability it is necessary to have sufficient "Courtelle" present in the blend.

Choice of Denier and Staple Length—Staple length is largely determined by the spinning system used. Denier is selected according to handle required within the limits set by the count required. For firm handling fabric 4½ or 6 den. fibre may be required whereas for soft fabric 2 or 3 denier. fibre will be chosen.

Cloth Construction Using Standard "Courtelle"

Adequate width shrinkage should be allowed from reed width in loom to finished cloth width. Construction should not be too compact otherwise performance in use will suffer due to a greater risk of creasing. Where, however, certain types of open sett woollen spun fabric are being produced it should be borne in mind that no milling takes place with "Courtelle" and it may be necessary to close the sett slightly to prevent low seam slippage.

Cloth Construction Using High Bulk "Courtelle"—When using high bulk yarns allowance must be made firstly for the yarn shrinkage of 15 to 18% secondly for a corresponding decrease in yarn count and thirdly for an increase in effective yarn diameter due to bulking.

Knitted Fabric Construction

Generally speaking, knitted fabrics by virtue of their structure—interdependent loops—cannot be produced with the same density as woven fabrics, hence when using "Courtelle" yarns there is much less risk of over constructing than with woven fabrics. If one could speak of a "golden rule" to follow when constructing knitted

fabric from acrylic yarns it would be "to knit firm." This particularly applies to hand knitting and machine knitting of dyed relaxed high bulk yarns and standard non-high bulk yarns. Where however a knitter is using unrelaxed high bulk yarns which will subsequently be relaxed in garment form then slacker knitting is called for and a certain amount of experiment is required to obtain the most satisfactory finished results.

Dyeing, Printing and Finishing

"Courtelle" can be dyed to a full range of shades both in pale, medium and dark shades. The disperse dyes are recommended for pale to medium shades and the new basic colours for medium to dark shades. Most dyestuffs' manufacturers put out ranges of colours suitable for dyeing "Courtelle." Quite adequate colour fastness for all end uses can be obtained. When printing 100% "Courtelle" the same dyestuffs as for dyeing can be used, but when the fabric is a blend of "Courtelle"/cotton or "Courtelle"/viscose vat colours can be used.

Regarding finishing, one can speak almost without exception of a "golden rule" for handling fabrics produced from "Courtelle". The fabric should be allowed to develop to the maximum fullness. High temperatures and tensions should be avoided like the plague Pressing or decatizing if found necessary to give smartness should be as light as possible. Acrylic fibres are not very sensitive to moisture, but they are very sensitive to heat and pressure. Virtually pure finishes are best for 100% "Courtelle" fabric, a small amount of a cationic finish being used but not sufficient to impart a greasy handle.

End Uses

"Courtelle" has a wide variety of end uses and its main attributes are found in:—

(1) Easy care clothing.
(2) Lightness with warmth.
(3) Clear bright colours or delicate pastel shades.
(4) Stability in washing with quick drying.
(5) Ability to take frequent washing without material loss of appearance and with no felting.

From the above it will be readily appreciated why acrylics make their most useful contribution in knitwear, knitted dresses, lightweight woollen spun dress fabric, blankets and the like and make a doubtful contribution in, say, men's overcoating.

Knitwear—Most knitwear is made from Turbo high bulk yarns spun on the worsted system. The denier of fibre used is selected according to the handle required and the type of knitted structure used. For soft handle with classic type garments knitted on 21 gauge full-fashioned machines 3 den. fibre would be used, whereas for a crisp handling bulky knit garment produced on, say, a 3½ gauge flat machine, 6 den. fibre would be used.

Double Jersey Fabrics—This is a type of fabric produced on circular machines having both cylinder and dial needles. The fabric is firm in structure and in recent years the number of machines installed and about to be installed for producing this type of fabric has increased tremendously. The use of "Courtelle" in this type of fabric has been a happy combination as it has permitted fabrics to be produced in both full and pastel shades for dresses and suits which can be washed (most important for pastel shades) and so make this fabric suitable for all seasons' wear. The fabric is best produced from slubbing dyed yarns spun from 4½ den. standard "Courtelle."

Single Jersey Fabrics—By the use of "Courtelle" high bulk yarn, fabrics knitted on single jersey machines can be finished to give reasonably firm light-weight fabrics particularly suitable for ladies' lightweight knitwear and blouses, men's sports shirts and ladies' printed dresses.

Fleece Fabrics—This is a class of fabric used for a wide variety of end uses; Children's sleeping bags, dressing gowns, trimmings, pram coats, backs of gloves, etc. The fabric—usually knitted—uses a cotton spun "Courtelle" backing yarn and a "Courtelle" woollen spun face yarn. The main virtues are kindness of handle, lightness with warmth, stability and quickness of drying after washing.

Pile Fabrics—These may be knitted or woven but whichever method is used the fibre must be dyed before spinning for best results. With woven pile fabrics yarns are usually worsted spun from dyed slubbing using bright fibre. For knitting, either a coarse worsted spun yarn is used for the pile knitted on the Supreme H.P. machine or a woollen spun sliver is used for knitting on the Wildman machine. No matter which method is used to produce pile fabric from "Courtelle" they are characterised by having a more furlike handle and appearance than pile fabric made from other non-acrylic fibres.

Scatter Rugs—A type of pile fabric using a blend of "Courtelle" and a modified acrylic fibre is being used for scatter rugs which can be hand or domestic-machine washed.

Hand Knitting Yarns—This is a very recent development for "Courtelle" but one which could have far-reaching results on the hand knitting trade. Most "Courtelle" hand knitting yarns are produced from high bulk yarns though very satisfactory garments have been produced from standard "Courtelle" 4-ply and double knit hand knitting yarns.

Underwear.—Warm, comfortable and stable ladies' and men's underwear has been produced. Most ladies' underwear has been produced from cotton spun yarns on 10 and 12 needle R.T.R. machines. For men's underwear both cotton spun and worsted spun yarns have been used spun from standard "Courtelle."

Woven Washable Dress Fabrics.—For really light-weight dresses, fabrics of the Mousseline type are produced from cotton spun "Courtelle" yarns, the fabric being printed with well covered screen printed designs. For medium-weight fabrics, woollen and worsted spun cloths are used both in piece dye and coloured woven, both in 100% "Courtelle" and in blends of "Courtelle" and wool.

Ladies' Washable Suiting Fabrics.—For this purpose many of the slightly heavier woollen and worsted spun dress fabrics in 100% "Courtelle" and in blends with wool are used. A minimum of 50% "Courtelle" is used and where really good pleating of the fabric is required a minimum of 60% "Courtelle" should be used.

Men's Lightweight Suitings and Tropical Suitings.—Blends of 50% "Courtelle"/50% wool have been used for lightweight suitings. The "Courtelle" gives greater press crease retention and preserves the original fabric appearance. It is stronger and less liable to shape distortion than the all-wool fabric.

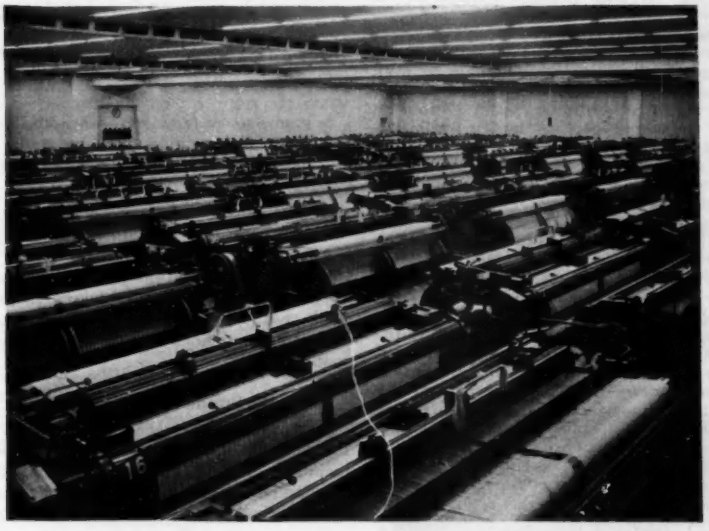
Blankets.—Here we recommend using "Courtelle" W type blend fibre. W.3 type gives a blanket having a handle similar to a Botany wool with good washing properties.

Noise Abatement in Modern Weaving Sheds

A report of investigations recently carried out by Sulzer Bros. in order to ascertain the position of the Sulzer machine in regard to noise, and what measures can be taken in weaving sheds to lower present noise levels

THE interest taken in the noise problem, both by the medical profession and by technicians, has increased considerably in the last few years. There is now a steady flow of scientific papers dealing with the nature of noise, its effect on human beings and the means of combating it. Noise is unfortunately a marked feature of weaving mills, and consideration for the well-being of mill workers demands that everything technically and economically possible should be done to reduce it. Competition from other, quieter industries will in any case make improvements in the weaving mill a necessity in the course of time.

During the last few months, Sulzer Bros., Winterthur, Switzerland, have undertaken extensive measurements and investigations to ascertain the position of the Sulzer weaving machine in regard to noise, and what measures can best be taken in weaving sheds to lower present noise levels.



An installation of Sulzer weaving machines

Some Elements of Acoustics

Noise abatement and sound damping are relatively new problems in the textile industry and in a bulletin issued recently by the company a few basic elements of acoustics are reviewed briefly. The *sound pressure level* is determined by measuring the oscillation pressure, i.e. the pressure fluctuations propagated in the air from sound sources, by means of electric instruments that register the sound through microphones. The resulting physical value is expressed in decibels (db.). This is a relative figure allowing us to distinguish differing degrees of physical, i.e. objective, loudness.

A second component of sound is its *pitch*, which depends on the *frequency*, i.e. the number of pressure oscillations per second (expressed in hertz or cycles/sec.). The human ear can hear notes from about 16 to 20,000 c.p.s.

The decibel scale is based on a sound of medium pitch, viz. 1,000 c.p.s. Such a sound reaches the threshold of audibility at a sound pressure of 0·0002 microbars; at this point the sound pressure level is 0 decibels. The threshold of feeling, where pain commences, lies at 120 decibels (see Fig. 1).

Unlike a pure tone, a noise such as made by running machines is always a mixture of pressure waves of different frequencies. Its composition is investigated by measuring the sound pressure level in decibels from octave to octave or from third to third (as in the two charts). The total level of a noise is also given in a single figure and is expressed in decibels. It is always higher than the highest measurement for the single octaves or thirds, since it is composed of these.

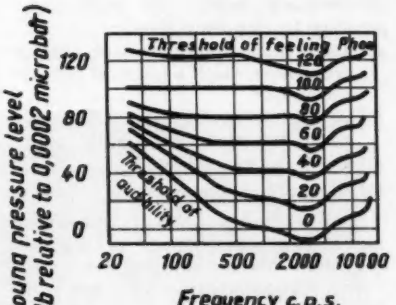


Fig. 1

The human ear judges the loudness of a sound by its pitch as well as its sound pressure. Sounds of 500 to 5,000 cycles /sec. are subjectively felt to be louder than lower and higher tones. The sound scale in decibels, based on a pitch of 1,000 c.p.s., must therefore be corrected or "weighted" to correspond to the actual sensitivity of the ear (see Fig. 1). The result is a more nearly physiological value known as *loudness level* and expressed in *phons*. Here again 0 is the threshold of audibility and 120 the level at which noise becomes painful.

Owing to the logarithmic character of the phon scale, loudness levels cannot be simply added to each other. A noise of 50 phons is not felt to be half as loud as one of 100 phons. Comparisons made with numerous juries and individuals have shown that above 40 phons a difference in loudness level of 9 phons corresponds to a doubling or halving of the subjective loudness. *In other words, a noise of* 91 *phons is just about half as loud as one of* 100 *phons*, and 82 phons are only one quarter as loud as 100 phons. This peculiarity of the phon scale must be taken into consideration in assessing the efficacy of sound damping measures. If noise is reduced by 3·5 phons by the use of sound absorbing materials, this means that the loudness of the noise has been cut down by about one quarter, which must be regarded as a good measure of success.

In order to obtain a scale whose mathematical ratios correspond to the ratios of subjective loudness, a new unit, the sone, has been introduced more

recently. A noise of 2 sones will consequently sound twice as loud as one of 1 sone. In this text use has been made of the scale proposed by Stephens, according to which 0 phons = 0·063 sones, 40 phons = 1 sone and 100 phons = 64 sones.

Noise and the Human Being

Excessive noise has a wearing effect on the human nervous system. Fatigue, increased cerebral and blood pressure, irritability, inability to concentrate and states of depression result from loud and protracted noise such as is often encountered in industrial plant.

Extensive investigations have shown that noises below the "annoyance level" of 50 sones per octave do not have any deleterious or injurious effect on the human ear and nervous system. It is only in the range between the curve for 50 sones and that for 100 sones per octave that noise becomes annoying and may also be physically injurious. Fatigue or even damaging of the ear drum—with loss of hearing in certain ranges—and a strain on the vegetative nervous system will certainly be caused by noise in excess of the 100-sones-per-octave level. This may consequently be referred to as the deafness or loss-of-hearing curve.

Injury to the human organism as a result of noise was regarded till a few years ago as an unavoidable professional hazard. Now that the nature of noise has been investigated and measures for combating it have found, this view is recognised as unfounded. Several European countries have already promulgated laws and regulations for the prevention of unnecessary noise. Today it is of the greatest importance that every machine manufacturer, factory planner and works owner should tackle the problem of noise abatement without delay and should introduce suitable counter-measures.

Sound Analyses in a Cotton Weaving Shed with 384 Sulzer Weaving Machines

Noise cannot be successfully reduced in industrial plant unless the noise level of the various machines and equipment is known. Sulzer Bros., therefore undertook a series of sound measurements with their weaving machines and Chart 1 shows an analysis of the noise in the weaving shed of a cotton mill in which 384 Sulzer weaving machine of type 130 ES 10 E (130 ins. reed space) were running simultaneously. The measurements yielded the following information:—

(1) The noise caused by the Sulzer machines covers the whole range of frequencies perceived by the human ear, but remains at all points below 90 decibels and *below the annoyance curve*. There is no distinct focal point. The sound is distributed fairly evenly over the whole range of frequences and in practice is equivalent to a loud but steady hum, a type of noise which is more easily supported by the human ear.

(2) The noise level in the weaving shed may be influenced by the density of the cloth, i.e. its weights per unit area. Thus a total noise level of 93·0 decibels* (over the whole frequency spectrum) was registered near machines weaving goods of 200 grams/sq. m. and less, while the total figure for machines weaving cloths of higher weight per unit area was 95·5 decibels.

(3) The sound pressure level in the warp-side alleyway differs very little from that in the weaver's alley.

It should be added that at the time when the measurements were taken neither walls nor ceiling of the weaving room concerned were lined with sound-absorbing materials.

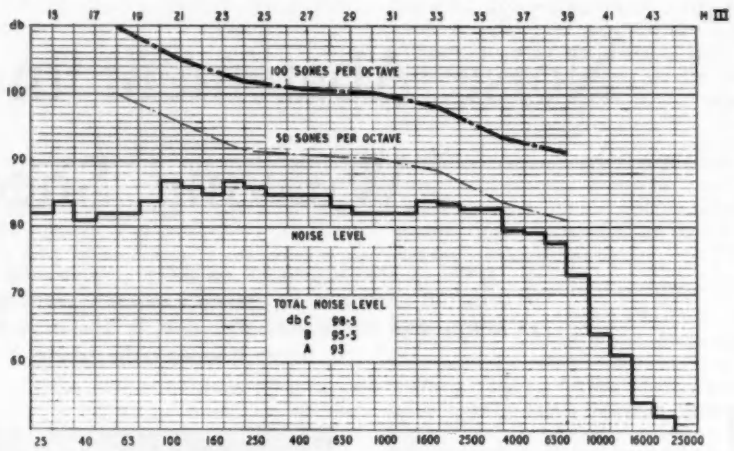


Chart 1. Sound analysis – 384 weaving machines (Type 130, ES. 10. 10E)

Sound Damping

The noise of a machine running in a room can be damped by extraneous measures, and in particular by the use of sound-absorbing panels. In collaboration with well-known makers of acoustic materials, Sulzer Bros. have developed a sound-absorbing panel specially suitable for weaving sheds. The requirements specified for this panel were:—

(1) Good sound absorption at the higher frequencies which are here of primary importance.

(2) A mechanically resistant surface on which dust cannot easily settle.

(3) Resistance to humidity.

(4) Acceptable price.

The panel finally chosen has the following principal characteristics: (*a*) diameter of holes 7·5 mm.; (*b*) depth of holes 15 mm.; (*c*) panel surface 20% perforated (*d*) high sound absorption capacity from 1,000 c.p.s. upwards.; (*e*) wood fibre panel with hardplate covering. Tests in the laboratory with this panel have yielded comparatively good results, the absorption coefficients lying between 0·5 and 0·9.

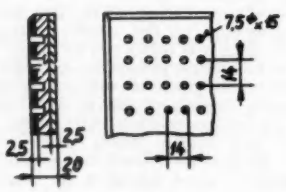


Fig. 2

Damping Measures in a Wool Weaving Shed with 24 Sulzer Machines

The noise level of Sulzer Weaving Machines of types 85 ZS 10 E and 85 VS 10 E (reed space 85 ins.) is higher than that of the 130 ins. machines. Sound analyses in a weaving shed without sound-absorbing panels showed the weaving machines of type 85 ZS 10 E produced noise rising at some points above the 50-sone-per-octave limit. This is presumably due to the higher speed.

The walls and ceiling of the weaving room in question were then fitted with sound-absorbing panels of the type described, 48% of the wall area and 70% of the ceiling area being covered. The noise measurements were then repeated. (In the meantime twelve 85 VS 10 E machines had been added to the existing twelve 85 ZS 10 E units.)

As the sound analysis (Chart 2) shows, the noise level was now *below the annoyance curve over the whole range of frequences*, and the values for the total noise were as follows:—

(1) In the weaver's gangway .. .. .. 91 decibels

(2) At the centre of the room, approx 1·5 metres from the weaving machines .. 87 decibels

(4) Approx. 10 metres from the weaving machines .. .. 78 decibels

This means that the use of the acoustic panels had resulted in a noise abatement of 2, 5·5 and 11 decibels, according to the point of measurement.

Summing up, Sulzer Bros., state in the light of present-day knowledge, that the noise of 130 ins. Sulzer weaving machines does not unfavourably affect the health or performance of operators. The noise

(*continued on page* 53)

Cotton Doubling: Reorganisation at a Well-Known Scottish Mill

Introduction of "two-for-one doubling spindles" is reported to have increased production and reduced the costs

FIFTEEN thousand pounds of yarn from 480 Scragg double-twist spindles in a 45-hour week, replacing a similar production from 1,690 ring and flyer doubling spindles, a 40% reduction in operator time and an increase of 700% on maximum doubled package size. This is part of the successful re-organisation of processing facilities achieved by Jute Industries Ltd., Stanley Cotton Mills, Stanley, Perthshire.

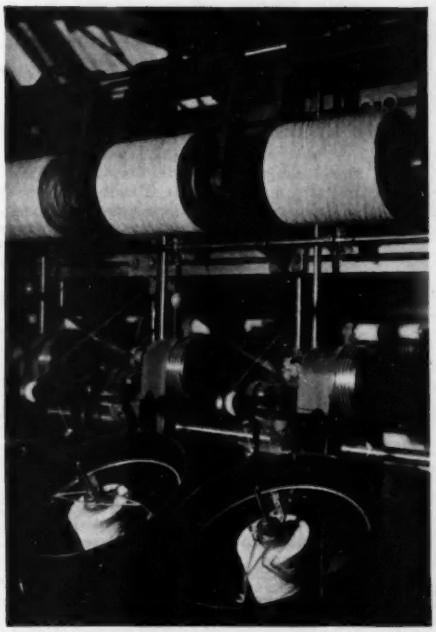
Twelve months in operation, an installation of 12 S.D.T. double-twist machines supplied by Ernest Scragg and Sons Ltd., Macclesfield, is now continuously engaged in the production of knotless 3 or 6 lb. conical or parallel packages at twist insertion rates of up to 15,500 turns/min. Working efficiencies of 93% are said to be consistently maintained, and it has been found in practice that 1,000 lb. of 9/9's yarn, for example, with 5 t.p.i. at twisting speed of 8,400 turns/min., can be processed in a 9-hour day.

The S.D.T. double-twist system uses a stationary supply package. Yarn is drawn off over-end, taken through a flyer mounted above the package, down the centre of a stationary spindle tube, through a slot in the spindle base, and then upwards through a control eye above the flyer to a gear-driven yarn delivery roller and finally taken up at the top of the machine on to a cheese or cone as required. In this way two turns of twist are inserted into the yarn for one revolution of the spindle rotor.

In adopting the S.D.T. double-twist system, Stanley Cotton Mills were influenced by the rising demand for the largest possible package of knotless yarn for industrial purposes, for heavy sewing threads, for tufted carpets and candlewicks and to fulfil government contracts which stipulate optimum regularity of yarn strength and uniform, high quality fabric construction. These demands were almost universally for yarn packages of 4 to 8 lb. capacity regardless of yarn count. In order to meet these requirements, and to produce medium to coarse doubled yarn on a competitive cost basis but with superior characteristics of evenness and yarn strength regularity, the Scragg S.D.T. system has, claims the company, been adopted with complete success. Not only are very great lengths of knotless folded yarn produced; the knots themselves are tied in the single end, with obvious advantage in subsequent processing.

The S.D.T. installation at Stanley Cotton Mills comprises twelve machines arranged in two parallel lines of six, totalling 480 spindles. Four of the machines are S.D.T.4 models with 48 spindles capable of producing up to 4 lb. packages, while the remaining

The Scragg S.D.T. installation at Stanley Cotton Mills comprises 4 S.D.T.4 machines and 8 S.D.T.8 machines, arranged in two parallel lines. Four operatives attend the entire installation which comprises 480 spindles replacing 1,690 ring and flyer doubling spindles previously used



Close-up of the Scragg S.D.T. double-twist yarn processing layout. The supply package is stationary. The yarn is drawn-off over-end, passed round a flyer mounted above the package, down the centre of a stationary spindle tube, through a slot in the spindle base and then upwards through a control eye above the flyer to a positively-driven delivery roller and finally taken-up onto a parallel (or taper) package

(left) Stage II in the S.D.T. yarn system. The yarn is cleared and wound from 2·8oz spinning bobbins onto a 2 lb. 3 30 ft. cone prior to assembly-winding the supply packages for the S.D.T machines. All knots are therefore inserted in the single end yarn only

(right) Stage II is the S.D.T. yarn system. Assembly winding knotless 3 or 6 lb. parallel supply packages (up to 6 ends) from 2 lb. cones of yarn. Measured lengths of yarn can be processed on the S. D. T. machines when required

eight machines are S.D.T.8 models, with 36 spindles, capable of producing up to 8 lb. packages, the package weight depending on the type and count of yarn twisted.

In the Stanley Mills operation, the S.D.T.4 machines produce a cone of 3° 30′ taper or parallel cheese of 2/12's, 2/14's, 3/12's and 3/14's cotton count, at 15,500 turns/min. The S.D.T.8 machines produce a parallel cheese or large cone at a speed of 10,400 turns/min., for yarns up to a resultant count of 3's and at 12,600 turns/min. for yarns over 3's resultant count. Four female operatives attend the 480 spindles, and one man carries out all yarn transportation for the entire installation.

The S.D.T. double-twisting system with its associated winders replaces a former installation of 1,200 ring doubling spindles and 490 flyer spindles, one 260 spindle winding frame and one 40 drum machine for finisher-winding. The largest twisted package produced on the old system was 12 oz. which necessarily resulted in numerous knots being included in the finished doubled or folded assembly package. A total of 35 operatives were required to attend the entire winding—twisting—finish winding installation, compared with with 21 on the new S.D.T. system.

Comparison of the old and new systems is shown in Tables I and 2.

The production of S.D.T. processed yarn is accomplished in three distinct operations following the production of the spinning package. The cotton yarn is first cleared and wound on to single-end 3° 30′ cones from spinning packages each containing 2·8 oz. of the yarn of 12's count or

TABLE 1

S.D.T. METHOD

	No. of Spindles	Package Weight	No. of Operatives
STAGE I—Single-End Cone Winding			
1 × 120-spindle Winding Frame 1 × 100-spindle Winding Frame	220	2 lb.	12
STAGE II—Assembly Winding			
1 × 84-spindle Winding Frame ..	84	6 lb. (S.D.T.8) 3 lb. (S.D.T.4)	4
STAGE III—S.D.T. Double-Twisting			
8 × S.D.T.8 × 36 spindles	288	6 lb. parallel 3 lb. cone	4*
4 × S.D.T.4 × 48-spindles	192		
		TOTAL OPERATIVES	20

Machinery and Operative Requirements for Winding and Doubling 15,000 lb. of 3·63's average Resultant Count Yarn in a 45-hour working week.
*** Transport of yarn excluded**

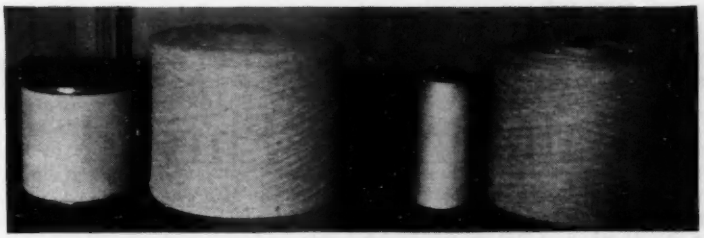
TABLE 2

FORMER METHOD

	No. of Spindles	Package Weight	No. of Operatives
1 × 260-spindle split drum winding frame	260	2½ lb.	13
3 Flyer Frames: 1 × 240-spindles 1 × 170-spindles 1 × 80-spindles	490	12 oz.	
5 × 240-spindle Ring Doubling Frames: (3 in. dia. ring × 5 in. traverse)	1,200	8 oz.	14*
1 × 40-spindle split drum finisher Winder	40	5 lb.	8
		TOTAL OPERATIVES	35

Machinery and Operative Requirements for Winding and Doubling 15,000 lb. of 3·63's Average Resultant Count Yarn in a 45-hour Working week

*** Transport of yarn excluded**



Comparison of package sizes and weights between the old and new doubling systems. On the left is a 2¼ lb. ring doubler supply bobbin compared with a 6 lb. supply package of knotless assembly-wound yarn for the S.D.T. machine. On the right is an 8 oz., 3 in. ring doubler package compared with a 6 lb. parallel package produced by the S.D.T. machine

above, or 3·1 oz. of yarn up to 12's count. In both cases a 2 lb. package is produced at a winding speed of 500 yds./min.

In the second stage, assembly winding for S.D.T. supply packages is accomplished at 380 yds./min. to produce a parallel cheese containing 6 lb. of yarn for the S.D.T.8 machine and 3 lb. of yarn for the S.D.T.4. Twisting and doubling is therefore carried out on the S.D.T. machines from perfectly wound parallel cheeses, any knots having been inserted at the single-end stage alone.

Of the total quantity of yarn spun by Stanley Cotton Mills ring spinning section, approximately 75% is produced on the S.D.T. installation. These yarns are used in the mill's own weaving section, in the production of cotton ducks, webbings, beltings and also for direct yarn sales. Stanley Cotton Mills are a vertical concern, spinning and weaving being carried out on the premises. For direct sales, 3/8's. 4/8's, 5/8's and 3/10's yarn are produced for industrial sewing threads, 3/16's to 3/9's for duck fabrics, 6/8's, 4/12's and 7/16's for beltings and 3 and 5 fold 8's yarn for webbings.

One of the outstanding advantages claimed of the new system has been the effect in warp and weft preparation. Apart from increases in efficiency at these processes, there has been a distinct improvement in cloth quality and the improved weaving efficiency, most marked at the Northrop automatic looms, is almost entirely attributable to the longer lengths of knotless yarns produced by the S.D.T. technique.

In warping, less floorspace is required for the creels through the use of larger warping packages, while the warping efficiency has also been considerably increased by longer runs between package changes. It is significant also to note that preventative maintenance techniques have been put in force to eliminate mechanical stoppages while weight, twist, strength and overall quality checks are made once each day per machine.

Finally, the elimination of supply bobbins has shown considerable savings. Formerly, 19,000 double-flanged bobbins were required to service the twisting department alone. These bobbins, now eliminated, represented a very substantial cost item in the mill's inventory. On the present basis paper tubes are used throughout the operation—non-returnable in the case of the S.D.T. machines—representing only a fraction of former bobbin costs.

Cost savings have been made in other directions with the elimination of such accessories and sundries as ring travellers, rings, tapes, ropes and belts; while the considerable reduction in maintenance and lubrication requirements has resulted in tangible cost reductions. A substantial economy is the elimination of time taken to change ring diameters and travellers when changing counts on ring doubling machines, not to mention adjustments required to vary balloon and package shapes.

As a saga of achievement, this installation is impressive and constitutes yet another notable chapter in the history of a concern established in 1785. Stanley Mills has the distinction of having been the second Scottish mill built by Sir Richard Arkwright and has been in almost continuous operation since its inception. The installation of this S.D.T. system is yet another example of the confidence in the future which is evident in this very lively 175-years old concern.

Noise Abatement in Weaving Sheds

(*continued from page* 50)

of the faster-running 85 ins. types may be annoying but never has any injurious effects on the hearing. The new sound-absorbing panel is very well suited to the weaving mill and damps the noise so well that the noise level of the 85 ins. machines is reduced to a figure well below the annoyance curve. Both the weaving machine *per se* and the use of suitable sound-absorbing panels result in a noticeable improvement in the working conditions of the weaving mill.

* *All total noise measurements quoted in this text are based on the A weighting system.*

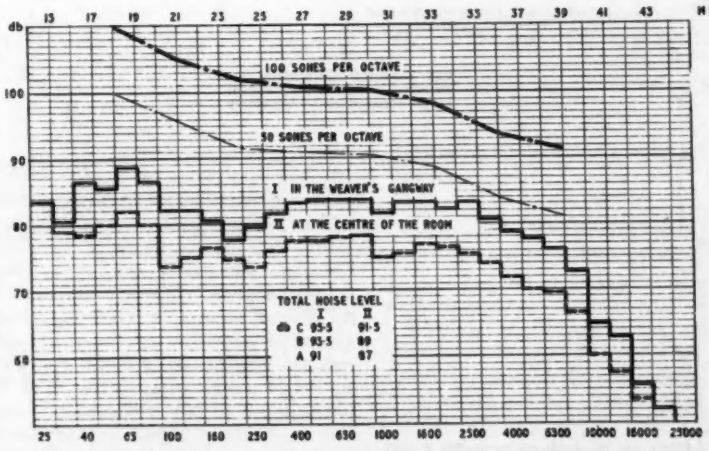

dB
M L/P
100 SONES PER OCTAVE
50 SONES PER OCTAVE
I IN THE WEAVER'S GANGWAY
II AT THE CENTRE OF THE ROOM
TOTAL NOISE LEVEL
I II
dB C 95·5 91·5
B 93·5 89
A 91 87
25 40 63 100 160 250 400 630 1000 1600 2500 4000 6300 10000 16000 25000

Chart 2. Sound analysis — 12 weaving machines (Type 85. ZS. 10E.) and 12 (Type 85. VS. 10E.)

New T.I. Committee

A new technological committee has been formed by the Textile Institute. It will discuss the subject of photo degradation of textiles and from time to time expect to issue recommendations.

Physics of a Ballooning Thread

Four excellent papers were presented at an important conference held recently in Bolton Technical College. Organised by the Education Department, it was attended by 120 delegates including mill managers, technologists and other executives. In this—the first of the four papers—the author deals with the nature of the forces acting on the yarn from roller nip to point of wind including wave pattern, effect of air-drag, yarn tension in spinning, etc.

By A. E. DE BARR, B.Sc., F.INST.P.*

AS is well-known, when a loop of yarn is rotated about an axis external to itself, as in spinning, doubling, winding or up-twisting, the yarn in the loop balloons outwards. This paper is concerned with the factors determining the shape and size of such balloons. The arguments apply equally well to balloons formed in any of the above processes but we shall discuss primarily the balloons formed in ring spinning (see Fig. 1).

Shape of a Ballooning Thread in Absence of Air-drag

To simplify the discussion we shall first assume that the loop of yarn is rotating in a vacuum. It is most important to appreciate that a finite balloon can be formed only if there is some means of maintaining tension in the yarn. Contrary to popular belief, the tension in the yarn is NOT caused by "centrifugal force." This point is illustrated by the example shown in Fig. 2. Here a mass M is rotating with angular velocity ω about an axis, and is constrained by a string which moves along its length at a velocity v when a tension T sufficient to overcome the resistance to motion of the string is applied. Then, in equilibrium

Tv = rate of doing work . . 1
$2T = M r \omega^2$ 2

If the string is fixed at both ends and $v = 0$, then no work is done and T may have any value (reactions at the supports at the ends of the string can maintain the necessary tension in the string). Equation 2 can, therefore, be satisfied for any value of r and therefore for any length of string. If there is no resistance to the movement of the string, then no work is done even when v is finite, and T must be zero. Thus, in these circumstances, either $r = 0$ or $\omega = 0$, i.e. the mass cannot rotate at a finite radius. If, however, work is done at a definite rate, then the value of T is fixed and, for a given value of ω, r is also fixed, i.e. for a given rate of working the system is in equilibrium only for one particular length of string.

Similar considerations apply to spinning balloons. The tension in the yarn is determined mainly by the work that has to be done against ring-traveller friction to keep the traveller rotating round the ring. The length of yarn in the balloon and the shape of the balloon are then determined. It

* *British Cotton Industry Research Association.*

(left) Fig 1 Diagram of a ring spinning system

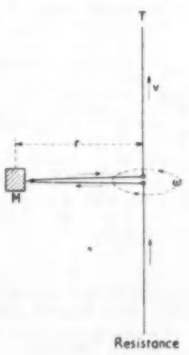
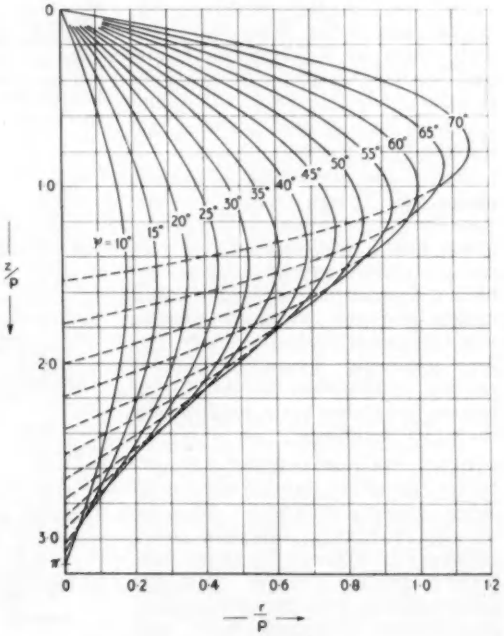


Fig. 2. Model illustrating the relation between centripetal force, tension and work done



(right) Fig. 3. Shape of spinning balloons in vacuo

is incorrect to say that the tension in the yarn is caused by "centrifugal force": the "centrifugal force" merely balances the tension already in the yarn as will be shown below.

If the weight of the yarn can be neglected, then there are no vertical forces on the system and the vertical component of the tension in the yarn is constant. The total tension in the yarn, however, is not constant as the horizontal component of tension must vary with radius in such a way that the centripetal force necessary to accelerate each element of yarn can be provided. The net horizontal force acting on any element of yarn in the balloon, i.e. the difference between the horizontal components of tension in the two elements of yarn on either side of that considered, must provide this centripetal force. The net horizontal force on each element of yarn must, therefore, always be directed radially inwards, and the horizontal component of tension in the yarn must decrease as the radius increases. The yarn in the balloon at any point lies along the direction of the resultant tension and the shape of the balloon is, in fact, a shape such that the vertical component of tension is constant whilst the horizontal component decreases as the radius increases.

The conditions for equilibrium of an element of yarn are easily shown to be

$$T = T_o - \tfrac{1}{2} mr^2 \omega^2 \quad . \quad . \quad . \quad . \quad 3$$

$$\frac{T}{T_o} = \frac{\cos \theta_o}{\cos \theta} \quad . \quad . \quad . \quad . \quad 4$$

where T is the tension in the yarn at any radius r, θ is the inclination of the yarn to the axis at that point, m is the mass per unit length of the yarn and ω is the angular velocity of the traveller. The suffix $_o$ refers to values of these quantities when $r = 0$.

The shape of the balloon is given by equations 3 and 4. Mack[1] has shown that these equations can be put into a form giving the relation between r and z—the axial distance from the thread-guide. Equations 3 and 4 represent a family of curves which can be represented in a non-dimensional form as in Fig. 3. Here $P = \sqrt{T_o/m\omega^2}$ -which has the dimensions of length—is a scale factor which is of fundamental importance in the theory of spinning balloons.

$$T_v = T_o \cos \theta_o \quad . \quad . \quad . \quad . \quad . \quad 5$$

The vertical component of tension in the yarn is given by
and this is the tension in the yarn at the point of maximum diameter. The maximum radius of the balloon is, therefore, given by

$$max^2 = \frac{2T_o}{m\omega^2}(1 - \cos \theta_o) = 2P^2(1 - \cos \theta_o) \quad . \quad . \quad 6$$

$$\text{or } \frac{r\,max}{P} = 2 \sin \frac{\theta_o}{2} \quad . \quad . \quad . \quad . \quad 7$$

Thus the maximum possible balloon radius is $P\sqrt{2}$.

It may be seen from Fig. 3 that the maximum axial length of a rotating loop of yarn is about 3·1 P. To understand the nature of this limitation, we consider now the propagation of transverse vibrations along a stretched string.

The velocity of propagation, c, of small traverse waves along a string is well-known to be given by

$$C = \sqrt{\frac{T_o}{m}} \quad . \quad . \quad . \quad . \quad . \quad 8$$

The wavelength, λ, of a vibration of frequency f is therefore

$$\lambda = \frac{c}{f} = \frac{1}{f}\sqrt{\frac{T_o}{m}} \quad . \quad . \quad . \quad . \quad 9$$

If both ends of the string are fixed, the wave is reflected successively from each end and the resulting motion of the string is determined by the superposition of the direct and reflected waves. It is easily shown that a stationary wave pattern is formed on the string when, but only when, its length is equal to an integral number of half wavelengths (Fig. 4). This effect is demonstrated in the classical experiment of Melde in which one end of a string is attached to a vibrating tuning fork, the other end being fixed. As the tension in the string is varied, stationary wave patterns are formed whenever the length is a multiple of $\lambda/2$, λ being given by equation 9. Points at which the displacement of the string is always zero are called nodes, the points at which the displacement is a maximum being called antinodes.

If now the string is made to vibrate simultaneously and at the same frequency, in two mutually perpendicular planes, the resultant motion will be determined by the superposition of the two component motions. The motion at any point on the string will be the sum of two simple harmonic vibrations at right angles, and if their amplitudes are equal and there is a phase difference of 90° between them, each point on the string will describe a circle about its equilibrium position. Instead of a plane polarised vibration we now have a circularly polarised vibration. The distance, l, between adjacent nodes is

$$l = \frac{\lambda}{2} = \frac{1}{2f}\sqrt{\frac{T_o}{m}} = \frac{\pi}{\omega}\sqrt{\frac{T_o}{m}} = \pi P \quad 10$$

A spinning balloon is essentially a stationary wave system formed by circularly polarised transverse vibrations of a string, and the axial length of any loop cannot exceed the natural half wavelength πP, without the formation of a node (see Fig. 3).

The velocity of propagation of small transverse waves on a string is $\sqrt{T_o/m}$, but as the amplitude of vibration, i.e. the radius of the balloon, increases, so the velocity decreases and the maximum length of balloons of finite radius is less than πP (see Fig. 3).

With a stretched string fixed at both ends, and a small amplitude of vibration, a stationary wave system can be formed only when the length of the string is equal to an integral number of half wavelengths. It is well-known,

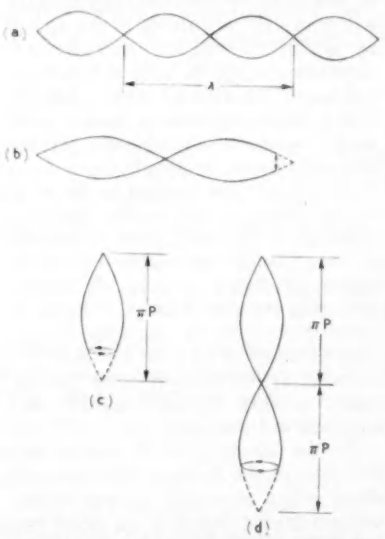


Fig. 4. Plane and circularly polarized stationary waves on a string

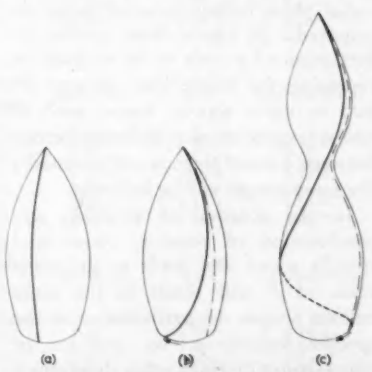


Fig. 5. Effect of air-drag on the shape of the loop of yarn between thread-guide and traveller

however, that, within wide limits, a stationary balloon pattern can be formed for almost any combination of ring radius, balloon height, count, spindle speed, etc. The essential difference between the two systems is that with the spinning system there is an additional degree of freedom in that, although the height of the balloon is fixed, the length of yarn in it is not. The length of yarn in the balloon adjusts itself, in accordance with the tension in the yarn, so that the yarn takes up the form of one of the family of curves shown in Fig. 3.

If the balloon height H and ring radius R are expressed non-dimensionally as H/P and R/P, then the balloon shape can be found as that curve in the family shown in Fig. 3 on which the point $\frac{r}{P} = \frac{R}{P}, \frac{z}{P} = \frac{H}{P}$ lies. Thus if $R/P = 0{\cdot}41$, $H/P = 1{\cdot}8$, then the balloon formed has a maximum radius given by $\frac{r_{max}}{P} = 0{\cdot}44$, and $\theta_o = 25°$. It should be noted that for any given values of R/P, H/P, there are two possible balloon shapes. In ring spinning, for reasons that will be apparent later, the balloon of smaller radius is the stable one.

Note that for any given values of R and H, the point R/P, H/P must lie on a line through the origin (the thread guide) making an angle $\tan^{-1}R/H$ with the axis of the balloon. The distance of this point from the origin depends upon the value of P. Furthermore, for given values of R and H there is a critical minimum value of P below which a balloon without a node cannot be formed. (When P is less than this critical value, the point R/P, H/P lies outside the family of curves shown in Fig. 3.)

If it is desired to spin with a value of P less than the critical minimum value, then balloon control rings are required. In effect these enable the formation of a node to be avoided by replacing the single loop of yarn by two or more shorter loops, each of which is quite stable. Balloons formed between control rings are of essentially the same nature as free balloons.

In the absence of air-drag, any combination of tension, count and spindle speed that leads to the same value of P will result in the same balloon shape. In particular, it is the specific tension—g wt. per tex or ounce-count product—that determines balloon shape, rather than the actual tension. If T_o is in dynes, m in g per cm. and ω in radians per sec., then $P = \sqrt{T_o/m\omega^2}$ is in cm. Alternatively, we have

$$P, \text{ cm} = \frac{94{\cdot}6}{n}\sqrt{\frac{T_o}{N}}$$

where n is the spindle speed in thousands of revolutions per minute

T_o/N is the specific tension in g wt. per tex

N is the yarn count in tex

Or P, inches

$$= \frac{8{\cdot}11}{n}\sqrt{\text{ounce-count product}}$$

Effect of Air-drag

In the absence of air-drag (and of friction at the thread guide and of any movement of the yarn along its length), all the forces acting on any element of the loop of yarn lie in a plane containing the axis and that element—an axial plane. Under these circumstances the loop of yarn must lie everywhere in an axial plane (Fig. 5a).

The principal effect of the resistance offered by the air to movement of the yarn is that work must be done to rotate each element of yarn. Each element must, therefore, be acted upon by a force with a moment about the axis, i.e. with a tangential component. This force can be provided only by the tension in the yarn which must, therefore, be such that there is a net tangential force, in the direction of rotation, on each element of yarn. The tangential component of tension in the yarn must, therefore, increase from the thread guide to the traveller, and the yarn (which always lies along the direction of the resultant tension) must be inclined to the axial plane in such a way that each element of yarn leads the element above it (Fig. 5b or c). The net tangential force on any element of yarn—the difference between the tangential components of tension in the elements on each side of that considered—is, therefore, always in the direction of rotation.

The product of the tangential component of tension in any element of yarn and the length of the circular path described by that element must be equal to the work done against air-drag in rotating the portion of yarn between that element and the thread guide. In particular, the product of the tangential component of tension at the traveller and the circumference of the ring must be equal to the total work per revolution required to rotate the balloon against air-drag. Note that this tangential component of tension

Fig. 6. Flash photograph showing effect of air-drag

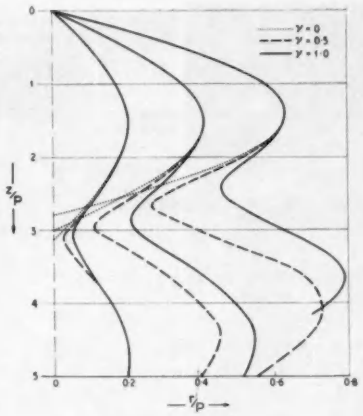
opposes the movement of the traveller: to keep the traveller rotating it is necessary to provide a force great enough to overcome ring-traveller friction and the tangential component of tension in the balloon. This force is provided by the winding tension which can be thought of as the means by which the spindle provides the necessary energy to keep the balloon rotating. The air-drag on any element of yarn can be regarded as proportional to the square of the velocity of that element relative to the air.

The greater the tension in the yarn in the balloon, the smaller the inclination to the axial plane necessary at the traveller to enable the work against air drag to be done. If, therefore, ring-traveller friction is large in comparison with the air-drag forces, the inclination of the yarn will be small. If, however, the tension in the yarn is caused mainly by air-drag, the inclination may be large.

As the air-drag forces act in the envelope of the balloon they have no direct effect upon the shape of the balloon profile (see Fig. 6): they do, however, affect this indirectly. The effect on the appearance of the balloon

(left) Fig. 7. Effect of air-drag on the diameter of the necks in a multiple balloon

(right) Fig. 8. Effect of air-drag on the profile of spinning balloons



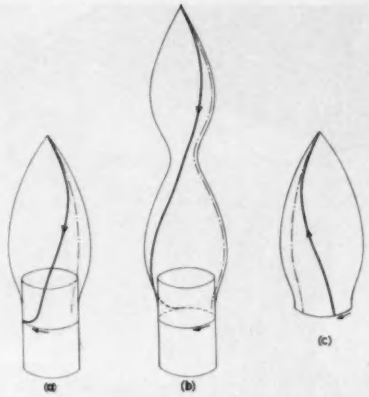


Fig. 9. Effect of Coriolis forces on the shape of the loop of yarn between thread-guide and traveller

is most pronounced in balloons with one or more nodes. In the absence of air-drag there is no tangential component of tension in the yarn and a true node can be formed if the total height of the balloon exceeds about 2·5 P. The effect of air-drag is that there is a tangential component of tension in the yarn and, as the product of this component of tension in any element and the circumference of the circular path described by that element must be equal to the work required, per revolution, to rotate the loop of yarn between that element and the thread guide, the radius of rotation of each element must remain finite. Thus a true node cannot now be formed and a neck of finite radius is formed instead. As the tangential component of tension in the yarn increases with distance from the thread guide less rapidly than the distance, the radius of each neck must be greater than that of the previous one. Mack has shown that the radius of the p^{th} neck is approximately p times that of the first neck (Fig. 7). The actual shapes of the balloon profiles when the effects of air-drag are considered are shown in Fig. 8. Here γ is an air-drag parameter given by $\gamma = \dfrac{C_1 \rho Pd}{2m}$, where C_1 is an air-drag coefficient, d is the diameter of the yarn and ρ is the density of air. (The normal air-drag force on an element of yarn is $C_1 \rho dv_1^2$ where v_1 is the normal component of the velocity of air relative to the yarn.)

The practical consequences of the small effects of air-drag on the balloon profile will be dealt with later.

Other Forces

For the sake of completeness we will mention here the other forces involved but in ring spinning these are all very much smaller than those associated with centripetal force, air-drag or ring-traveller friction.

(*i*) *Centripetal force* (*translation*).—In addition to the centripetal force required to maintain the rotation of the yarn, there will also be a centripetal force required on each element of yarn to keep it moving in the curved path between the thread guide and the traveller.

(*ii*) *Moving Yarn*.—The velocity of propagation of transverse waves along a stationary string is $\sqrt{T_o/m}$: if the string is moving along its length with velocity v, the effective velocity is reduced to $\sqrt{\dfrac{T_o - mv^2}{m}}$. Strictly, therefore, the value of P is given by $\sqrt{\dfrac{T_o - mv^2}{m\omega^2}}$.

(*iii*) *Coriolis Forces*.—As an element of yarn, whilst rotating, moves from a position at one radius to a new position at a greater radius, its kinetic energy of

Fig. 10. Forces acting on an element of yarn

Table 1

		Spindle speed, rev. min.$^{-1}$	Ring or cap diameter, cm.	Package diameter, cm.	Twist factor	Yarn speed, m. min.$^{-1}$	Twist turns, cm.$^{-1}$
Spinning or doubling	I	8,000	5·5	5	4·5	—	—
	II	8,000	5·5	5	0·5	—	—
Winding	I	0	—	5	—	200	(0·064)
	II	0	—	5	—	1,000	(0·064)
Up-twisting	I	8,000	—	5	—	(183)	0·5
	II	20,000	—	5	—	(5)	40

Table 2

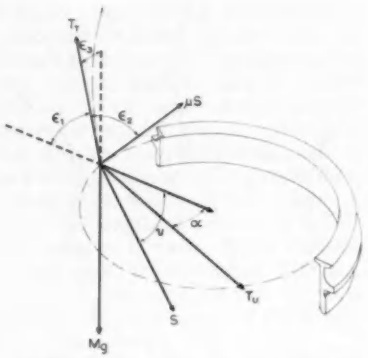
		Centripetal force (rotation)	Centripetal force (translation)	Air-drag	Coriolis force	Acceleration
Approximate maximum forces (g. wt.) on a 1 cm. length of yarn of 60 Tex ($m = 6 \cdot 10^{-4}$ g. cm.$^{-1}$)						
Spinning or doubling	I	2	$9 \cdot 10^{-6}$	$5 \cdot 10^{-1}$	$1 \cdot 10^{-3}$	$2 \cdot 10^{-4}$
	II	2	$6 \cdot 10^{-6}$	$4 \cdot 10^{-1}$	$1 \cdot 10^{-1}$	$8 \cdot 10^{-3}$
Winding	I	$3 \cdot 10^{-1}$	$1 \cdot 10^{-3}$	$6 \cdot 10^{-2}$	$2 \cdot 10^{-3}$	$3 \cdot 10^{-3}$
	II	1	$4 \cdot 10^{-3}$	$3 \cdot 10^{-1}$	$5 \cdot 10^{-1}$	$8 \cdot 10^{-1}$
Up-twisting	I	3	$1 \cdot 10^{-3}$	$6 \cdot 10^{-1}$	$1 \cdot 10^{-1}$	$3 \cdot 10^{-4}$
	II	9	$2 \cdot 10^{-7}$	2	$3 \cdot 10^{-3}$	$3 \cdot 10^{-4}$

Table 3

		Centripetal force (rotation)	Centripetal force (translation)	Air-drag	Coriolis force	Acceleration
Approximate maximum forces (g. wt.) on a 1 cm. length of yarn of 20 Tex ($m = 2 \cdot 10^{-4}$ g. cm.$^{-1}$)						
Spinning or doubling	I	$7 \cdot 10^{-1}$	$1 \cdot 10^{-6}$	$3 \cdot 10^{-1}$	$2 \cdot 10^{-3}$	$2 \cdot 10^{-5}$
	II	$7 \cdot 10^{-1}$	$7 \cdot 10^{-6}$	$3 \cdot 10^{-1}$	$1 \cdot 5 \cdot 10^{-3}$	$1 \cdot 10^{-3}$
Winding	I	$2 \cdot 10^{-1}$	$6 \cdot 10^{-4}$	$1 \cdot 10^{-2}$	$7 \cdot 10^{-3}$	$1 \cdot 10^{-3}$
	II	$5 \cdot 10^{-1}$	$1 \cdot 10^{-3}$	$3 \cdot 10^{-1}$	$2 \cdot 10^{-1}$	$3 \cdot 10^{-1}$
Up-twisting	I	$9 \cdot 10^{-1}$	$5 \cdot 10^{-4}$	$4 \cdot 10^{-1}$	$5 \cdot 10^{-3}$	$9 \cdot 10^{-3}$
	II	2	$6 \cdot 10^{-4}$	$6 \cdot 10^{-1}$	$1 \cdot 10^{-3}$	$1 \cdot 10^{-4}$

Table 4

		Centripetal force (rotation)	Centripetal force (translation)	Air-drag	Coriolis force	Acceleration
Approximate maximum forces (g. wt.) on a 1 cm. length of yarn of 6 Tex ($m = 6 \cdot 10^{-5}$ g. cm.$^{-1}$						
Spinning or doubling	I	$2 \cdot 10^{-1}$	$9 \cdot 10^{-6}$	$2 \cdot 10^{-1}$	$3 \cdot 10^{-4}$	$2 \cdot 10^{-4}$
	II	$2 \cdot 10^{-1}$	$7 \cdot 10^{-6}$	$2 \cdot 10^{-1}$	$3 \cdot 10^{-3}$	$1 \cdot 10^{-4}$
Winding	I	$2 \cdot 10^{-2}$	$2 \cdot 10^{-4}$	$2 \cdot 10^{-2}$	$2 \cdot 10^{-3}$	$3 \cdot 10^{-5}$
	II	$1 \cdot 10^{-1}$	$4 \cdot 10^{-5}$	$2 \cdot 10^{-1}$	$6 \cdot 10^{-3}$	$8 \cdot 10^{-5}$
Up-twisting	I	$3 \cdot 10^{-1}$	$1 \cdot 10^{-4}$	$2 \cdot 10^{-1}$	$1 \cdot 10^{-3}$	$3 \cdot 10^{-5}$
	II	$5 \cdot 10^{-1}$	$2 \cdot 10^{-6}$	$2 \cdot 10^{-1}$	$3 \cdot 10^{-4}$	$3 \cdot 10^{-7}$



(left) Fig. 11. Forces acting on the traveller in ring spinning

(right) Fig. 13. The fourth equation

$$T_U = \frac{\mu C}{\sin\alpha\cos\nu + \mu\cos\alpha - a(\mu\cos\epsilon_1 + \cos\nu\cos\epsilon_2)}$$

$$\sin\nu = \frac{a\mu(T_T\cos\epsilon_3 - Mg)}{T_T(\sin\alpha - a\cos\epsilon_2)}$$

$$\frac{T_U}{T_T} = e^{\mu_1\chi} = \frac{1}{a}$$

$$T_o = T_T + \tfrac{1}{2}mR^2\omega^2$$

$$T_T\cos\epsilon_2 = D = \frac{C_1\rho d\omega^2 Hr^3}{4R}$$

rotation increases. It must, therefore, have been acted upon by a force in the direction of rotation which must have done work upon the element. This is the Coriolis force associated with the radial velocity of a rotating particle. It acts in the direction of rotation when the element is moving radially outwards, and in the opposite direction when the element is moving radially inwards. There is also a Coriolis force associated with the tangential velocity of the element of yarn.

Coriolis forces can be large in winding processes but are usually very small in spinning. The effect on the shape of the yarn in the balloon is shown in Fig. 9.

Magnitude of the Forces

Tables 1 - 4 (Fig. 10) give an indication of the relative magnitudes of the various forces involved. Coriolis forces are proportional to the velocity of the yarn along its length and are, therefore, relatively unimportant in ring spinning. Centripetal force is proportional to the mass per unit length of the yarn as also is (usually) the tension in the yarn as a result of ring traveller friction — because the aim is to keep T_o/m constant. Air-drag forces are proportional to the diameter of the yarn and therefore to the square root of the mass per unit length. They are, therefore, relatively of greatest importance with fine yarns. As will be seen later, however, the effects of air-drag can be great even with coarse yarns.

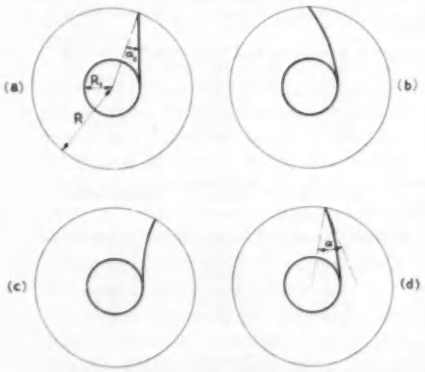


Fig. 12. Shape of the yarn between package and traveller
(a) If the yarn was mass-less and there was no air-drag
(b) Taking account of mass of yarn but ignoring air-drag
(c) The effect of air-drag alone
(d) The effect of movement of the yarn along its length

Yarn Tension in Ring Spinning

As already explained, the tension in the yarn in ring spinning arises because, in order to keep the traveller and the loop of yarn rotating, work must be done by the spindle against ring-traveller friction and air-drag. (Work is also done against yarn traveller friction and to rotate the drafting rollers, but the amounts involved are small.) The winding tension, and therefore the tension in any other part of the yarn, can be expressed in terms of the coefficient of friction between ring and traveller, by considering the forces acting on the traveller (Fig. 11).

(Strictly T_U is not equal to the winding tension T_W because the piece of yarn between traveller and package is subject to air-drag and Coriolis forces and does not lie in a straight line (Fig. 12). The difference, however, is small and can usually be ignored—T_U may be considered as the winding tension.)

Writing down the conditions of equilibrium of the traveller leads to the first two equations of Fig. 13. The tension in the yarn in the balloon at the traveller—T_T—is related to T_U by the effects of yarn-traveller friction—the third equation of Fig. 13. In addition, the relation between T_o and T_T can be obtained from equation 1 and this leads to the fourth equation of Fig. 13.

A complete solution of these equations demands a knowledge of the way in which the various angles α, ν, ϵ_1, ϵ_2 and ϵ_3 vary and there is no ready way of obtaining this information. Use can, however, be made of the fact that the work done per revolution against air-drag is equal to the product of the tangential component of tension $T_T\cos\epsilon_2$ and the circumference of the ring and as this work can be calculated — it is $\frac{\pi C_1\rho d\omega^2 Hr^3}{2}$ — the fifth equation of Fig. 13 can be obtained. (r is now the maximum radius of the balloon.)

By making some minor simplifying assumptions the equations of Fig. 14

$$T_U \triangleq \frac{\mu C + D\cos\nu}{\sin\alpha\cos\nu + \mu\cos\alpha}$$

$$\sin\nu \triangleq \frac{a\mu\sin\epsilon_2}{\sin\alpha - a\cos\epsilon_2}$$

$$T_T = aT_U = \frac{D}{\cos\epsilon_2}$$

$$\therefore T_o = T_T + \tfrac{1}{2}mR^2\omega^2$$

Fig. 14

can be obtained. The winding tension ($\triangleq T_U$) is the sum of two terms—one proportional to the ring-traveller and yarn-traveller friction and the other to the work done against air-drag. These equations form the starting point for the practical application of the results discussed in this paper.

Reference
(1) C. Mack, J. Tex. Inst., 1953, 44, T.483

Shorter Week in U.K. Woolcombing

The National Union of General and Municipal Workers has accepted the offer of the Wool (and Allied) Textile Employers' Council for a working week of 42½ hours in the woolcombing section of the industry, to come into force when the shorter working week operates for the remainder of the industry. This is the first day of the wages week beginning in the week commencing January 30. This does not mean that the shorter working week will come into operation on January 30 at all firms. Starting dates depend on when firms' pay weeks begin, and it could be any day in the week commencing January 30.

Fig. 1. Veneer peeling machine

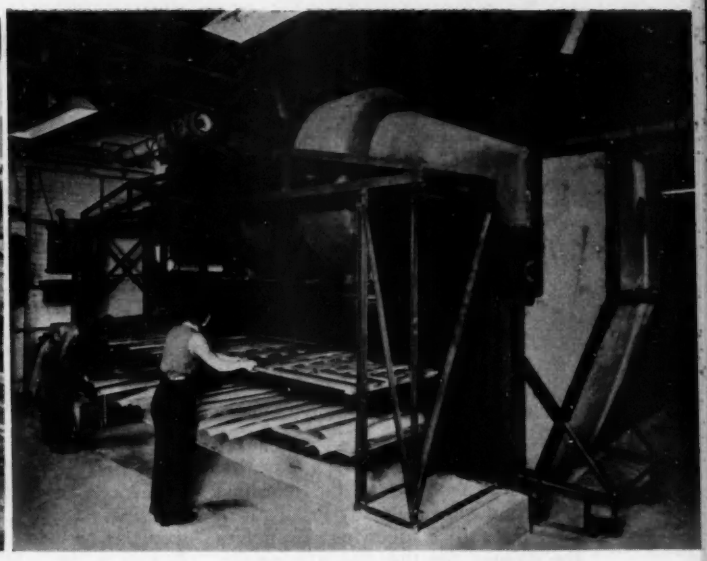


Fig. 2. Beech veneers being passed through a steam-heated dryer

Versatile Material for Textile Machinery and Accessories

Available in flat or curved sheets, rods or machined parts these specialities have countless applications

By A TECHNICAL CORRESPONDENT

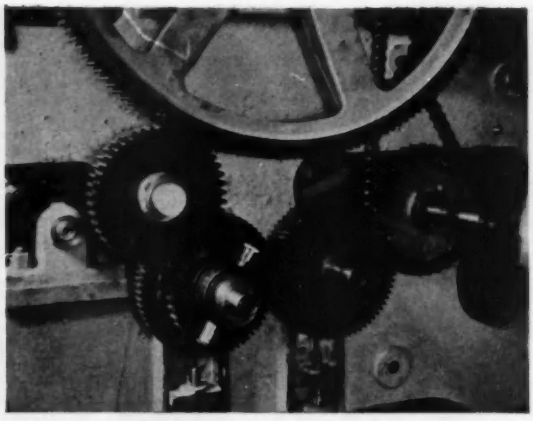
ONE can be a very long time in close contact with industry and have seen the use of a great number of special materials for design and construction, but nevertheless get a surprising insight into something new and very special. An invitation to the writer from a manufacturing firm nearby to visit their new factory produced such an effect. Here was a new plant, using very little mechanisation, and no automation, but it produces raw materials and machined parts for the textile machinery industry in a great variety. The product is "Permali," in which the raw materials are mainly wood veneer and plastic resins (Figs. 1 and 2) and the firm is Permali Ltd., Gloucester, whose associated company, Hordern-Richmond Ltd., markets the products of the group to the textile industry. The firm and its subsidiaries has associates in many countries, such as in France, the U.S.A. and Canada. The origin of the name is French. The process of complete resin impregnation and densification of laminated wood was first commercially exploited by S. A. Permali, of Nancy, France. The original development work had been carried out under the title "*Per*-fectionnment de *Ma*tières *Li*gneuses," from which the name "Permali" was coined.

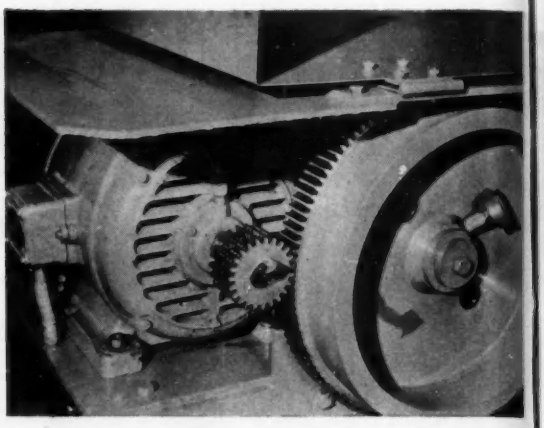
Physical, Mechanical etc. Properties

All grades of Permali are available in various types of build-up. This is an important and unique feature of Permali wood-base phenolic laminates since it allows the maximum strength of components to be developed in any required direction. The general appearance is an extremely homogenous impregnated and densified laminated wood. It is available in the form of flat or curved sheets, rods or machined parts. The natural surface of the sheets has a high polish but matt non-reflecting surfaces are also available together with various clear and pigmented varnish finishes. These finishing varnishes are recommended for all machined components. Each grade can be easily identified by its distinctive colour. The general machinability is excellent. "Permali" may be sawn, planed, turned, drilled, tapped and screwed. These operations may be carried out on standard machine tools, but the best results are obtained on specially adapted high-speed woodworking machines using abrasion resisting cutting tools. The sharp edges of all machined components and panels should be radiussed.

Silent Gears

Permali silent gears are widely used in construction of textile machinery because of their characteristic for noiseless operation, strength and wear resistance (Figs. 3 and 4). Their use in speed frame drives has become standard with prominent design engineers. Type 3 "Permali" has been developed for this purpose. It is made up of a series of fully impregnated





Figs. 3 and 4. Two applications amongst many of "Permali" gears in textile machinery drives

laminations, assembled in a way that the grain structure of the densified wood is disposed equally in all radial directions. The following advantages are claimed for the design engineer: uniform strength of all teeth, resistance against overloads and shocks, moisture resistance and easy lubrication (water, graphite or oil is permissible). Permali gears are available either as finished components, or in the form of blanks ready for machining. They are recommended for drives at pitch line velocities between 1,000 - 4,000 ft./min., and suitable for the heavy starting or stopping torques encountered in certain textile machines.

Loom Parts and Accessories

Two types of material are available for loom parts and other textile machinery components; Permali in its densified, vacuum-impregnated form, and Hydulignum made by the associated company, Hordern-Richmond Ltd. The latter is manufactured in high, medium or low density according to the application and combines high mechanical strength with good resilience properties. For looms weaving, carpets, wire or heavy woollens, a wide range of standard picking sticks is available in Permali. Lighter automatic and non-automatic looms are fitted with Hydulignum picking sticks. Sleys manufactured from Hydulignum are widely used and, because of the strength of the material, metal reinforcements are unnecessary. A Hydulignum sley can weigh no more than half that of a pine sley, yet it is claimed to be far stronger. Raceboards made from Permali are popular because they provide very smooth, wear-resistant shuttle action. Boards can be manufactured in one continuous length the full width of a loom. Many types of shuttle loom components, including swells, box backs and fronts and shuttle guides are made from Permali and Hydulignum materials which do not burn the shuttle and help considerably to bring the shuttle to rest in an extremely efficient manner before it is again propelled across the loom into the opposite box. The use of Permali and Hydulignum for sley components is said to give a cleaner surface for yarns carrying thin metal, as oil and dirt will not adhere to them and cannot therefore be carried into the warp.

A Versatile Material

Picking sticks made from Permali and Hydulignum have great bending strength, and are claimed to be free from fatigue. Practical experience with Permali wedges fitted to Northrop parallel motions are said to last much longer than hardwood or rawhide wedges, and facilitate correct alignment Lease and splitting rods, shuttle pins and shuttle walls are other items of merit. The list also embraces jockey pulley bearings, beam and bobbin flanges, jacquard needle boards, and the like.

Fig. 5. Varnishing "Hydulignum" picking sticks

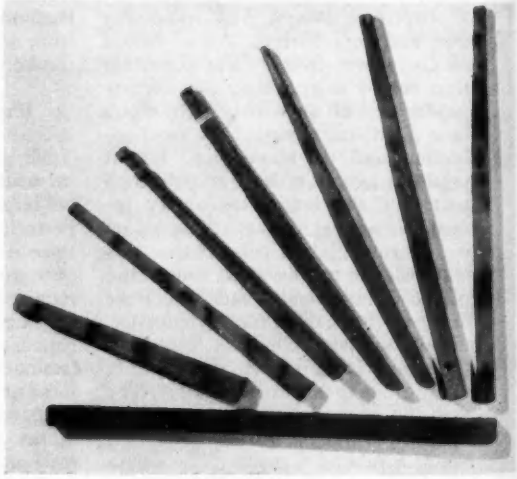


Fig. 6. A selection from the range of picking sticks for over-pick and under-pick looms

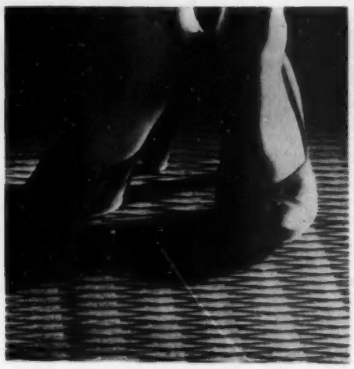


Fig. 7. Permatred flooring

TABLE 1. PROPERTIES OF PERMAGLASS

Comparative Properties of Permaglass Glass Fibre Reinforced Plastics (Average Mean Values quoted)	Polyester Resin Woven Cloth	Epoxide Resin Woven Cloth	Melamine Resin Woven Cloth	Phenolic Resin Woven Cloth
Physical Properties —				
Specific Gravity	1·77	1·90	1·95	1·90
Water absorption (mgs. absorbed after 24 hours)				
Sample, ½ in. thick	—	35	135	—
„ ¼ in. thick	27	—	—	55
Maximum working temperature °C.	110	130	*150	150
Thermal conductivity B.T.U./in./sq. ft./hr./°F. (Varies with resin content)	2·0	2·0	2·3	—
Co-efficient of linear expansion °F.	7 × 10-⁶	7·5 × 10-	7 × 10-⁶	7·5 × 10-⁶
Mechanical Properties —				
Bending strength, p.s.i. (flatwise)	36,200	60,000	20,000	50,000
Compressive strength, p.s.i. (flatwise)	51,600	75,000	60,000	60,000
Impact strength, ft./lbs. (½ in. unnotched specimen)				
11 to laminae	>10	>10	> 6	>10
1 to laminae	>10	>10	>10	>10
Modulus of flexure, p.s.i. (varies with resin content)	2·2 × 10⁴	3·5 × 10⁴	2 × 10⁴	2·2 × 10⁴
Electrical Properties —				
Power factor (tan), 50 cycles at 20°C.	·014	·020	·100	·200
1 to laminae, v./mil.	156	160	150	100
11 to laminae, Kv. per in.	42	40	25	25
Insulation resistance, megohms	30	10	5	5
Tracking time (Yarsley test)	>50 mins.	>50 mins.	>50 mins.	>1 min.

* Will not maintain combustion

Another material called "Permaglass" offers good prospects for the design of machinery guards. Permaglass is one of the latter additions to the range of high-strength reinforced plastic materials made in Gloucester. The permanence, dimensional stability and high filament strength of glass in its fibrous form is combined in Permaglass with various synthetic resins. Table 1 gives the properties, including resistance to moisture, high strength to weight ratio, and inertness are provided in this low-cost material. Various grades of Permaglass are available in form of laminated sheets, tubes, contact (wet-lay-up) mouldings, and vacuum-impregnated mouldings.

Table 2. Physical Properties of "Permatred"

Specific Gravity	1·20 gm. per c.c.
Bending Strength	14,000 lb./sq. in.
Young's Modulus (Bending)	1·7 × 10⁶ lb./sq. in.
Compressive Strength	30,000 lb./sq. in.
Water absorption (24 hrs.)	less than 3%

Permatred is highly resistant to petrol, oil, weak acid, and alkalis and is also proof against attack by fungus, termites and rodents. Whilst the material is inflammable, the ignition temperature (tested in accordance with B.S.738, Clause 16) is greater than 250°C.

It is claimed that greater design latitude is achieved with this novel material.

Permatred Flooring

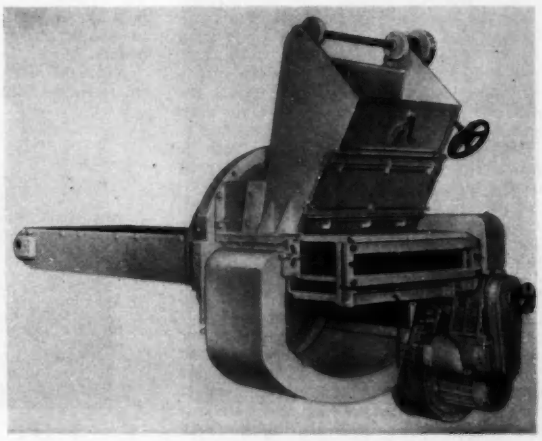
Of interest to the finishing industry should be a new flooring material made under the trade mark of "Permatred." This is a laminated flooring material based on wood veneer and synthetic resins similar to Permali (Fig. 7). Where corrosion problems are acute and wear resistance is important this material is recommended. It retains the pleasing appearance of natural wood and is weight saving. Table 2 gives some physical properties.

The latest product of the Permali group is "Perma-Flon," which is "non-wettable" and impervious to moisture. It is available in block, cylinders, rods, and as reinforced or filled sheets, etc. Various additions, such as asbestos, glass and metal powders modify the characteristics of this material. Small machined parts are available, or blanks may be supplied for machining. It can also be used for coating metal components by the spray method, or by dipping. All ferrous and many non-ferrous metals can be coated, and also sand-blasted glass and pure glass cloth. The coatings have to be stabilised by heat at 350°C. to 400°C. Permaflon in its various forms opens up a new wide field for the design engineer.

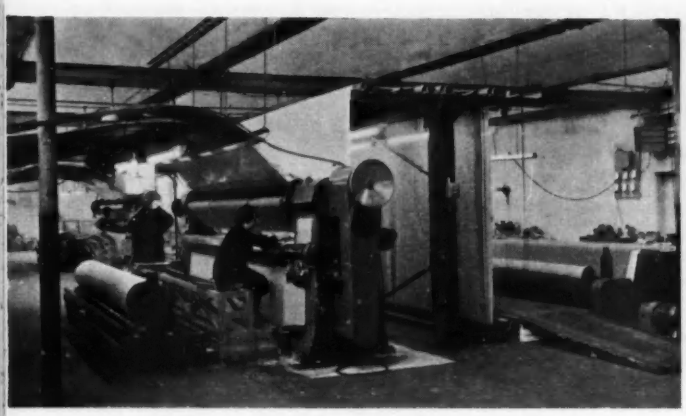
New Chain Grate Stoker

THE Mark IV chain grate stoker recently announced by James Hodgkinson (Salford) Ltd. and Bennis Combustion Ltd., Little Hulton, Walkden, is the result of the accumulated experience of both companies over a number of years and it is claimed that its many design features make it the foremost stoker of its type to be manufactured. The grate has been redesigned — there are now three patterns of links — giving full self cleaning action and clearer air spaces for improved cooling and more effective distribution of primary air resulting in better combustion and higher output.

Link rods are shouldered for positive tightening without restricting link movement and there is full diameter penetration of the side links. A positive and almost friction free drive is obtained with redesigned front sprockets bearing on all driving links through rollers incorporated in the grate, and the new rear drum, which supports the full width of the grate. As with previous models, automatic combustion control equipment is available for this stoker, and special internal baffles based of the latest research data, are also available.



Automatic combustion control equipment is available, also special internal baffles



The 12 ft. (foreground) and 15 ft. B.T.M. $\frac{1}{8}$ in. gauge, cut-pile tufting machines at Ribble Carpets Ltd.

A view of the combined latexer and stenter dryer designed and built by British Tufting Machinery Ltd.

Developments in the Tufting Industry

Working two 8-hour shifts, in what was formerly a cotton mill, a Blackburn firm now produce 35,000 sq. yds. per week of $\frac{1}{8}$ in. gauge tufted carpeting

THE latest tufted carpet factory to go into bulk production in Britain is that of Ribble Carpets Ltd., Highfield Road, Blackburn, Lancashire. Equipped with tufting plant supplied by B.T.M., it is making 1/8 gauge cut pile tufted carpeting and already a big market for the firm's products has been developed

Emphasis, according to Mr J. S. Minshull (sales manager) is on making an all-viscose cut pile carpet of better quality, thus raising standards in general and offering a finer product. The 1/8 gauge cut pile carpet is now being made in seven mottles and 4 plain shades with 11 stitches/in. The next stage is to introduce a patterned carpet which will be marketed under the brand Ribbleweave.

Mr. Minshull stated that at present, with the two British Tufting machines—12 ft. and 15 ft.—they were making 35,000 sq. yds. of carpet per week, representing an annual turnover of something in the region of £1,500,000 per year. The mill is at present running on two eight-hour shifts. Employing 100 workers at present, it is envisaged that this figure will be raised to about 250 within the next twelve months.

Initially, tufting started in this mill with a single 1/8 gauge cut pile B.T.M. machine and this was followed by the very latest B.T.M. combined latexer and stenter dryer. The cloth is taken from the tufter direct to the feed end of the latexer and fed into the machine which is of the three-pass type. This new design of stenter dryer is a major development by British Tufting Machinery, who express the view that it enables the manufacturer to adjust carpet width to a constant figure throughout the length of the carpet. During the three passes through the compact dryer, the carpet is held at all times, very firmly on the pin chain. When delivered at the other end from the latexing, the carpet is fed between two slitting heads and trimmed to width.

In anticipation of the installation of the second machine, of 15 ft, width Ribble installed a latexing plant capable of handling broadloom carpeting of this width. It was interesting to note, at a recent open day, that visitors found this new machine extremely compact in design, while being very economical in the amount of steam it uses. After latexing, the carpet is cured and finally trimmed to width, then taken to a slitting machine where it can be slit still further to any width from say the narrowest stair carpeting to any of the normal widths. Now in full operation is a cut-length service which specialises in ensuring very quick turn round of orders.

Although Mr. G. E. Rudland-Marshall (managing director) has sold the bulk of his production for some time to come, he is now working on further developments, such as the three-colour patterned effect of their new Ribbleweave patterned carpeting. It is predicted that this will have the same good acceptance in the trade as the range of Blue Book carpets now selling in shops throughout the British Isles.

Mr. Rudland-Marshall, who has had considerable experience in the manufacture and marketing of tufted carpets over the past few years, managed to set up his new plant in only six months, such is his enthusiam for this new product. He firmly believes that not only is the tufted carpet now a permanent feature of the British carpet trade, but that it will continue to account for a growing proportion of total carpet sales over the coming years. In establishing themselves in the carpet trade, Mr. Rutland-Marshall, believes that the trend will inevitably be towards better and still better quality tufted carpets

Mr. G. E. Rudland-Marshall (managing director, Ribble Carpets Ltd.) with Mr. S. Shorrock (British Tufting Machinery Ltd.) watching the combined latexer and stenter dryer installed by B.T.M.

TEXTILE MACHINERY and MILL EQUIPMENT NEWS

New Automatic Cone and Cheese Winder

Many features in this new machine were discussed in a recent lecture to mill managers and other executives at Blackburn Technical College

THE well-known automatic spoolers of the large group type, where one knotter serves a very large number of spindles, perform automatically only the winding of the yarn from the spinning cop into packages. Therefore, if a yarn break occurs, the partly unwound cop must be handled by the operator and re-fed. The operators consequently try to keep the yarn breaks as low as possible. The same applies to the manually operated cone or cheese winders where every yarn break must be attended to by the operator.

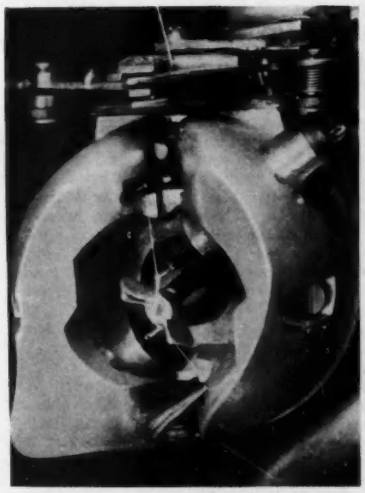
Modern machines should not only wind the yarn from the spinning cops on to packages, but simultaneously detect and cut out all unwanted places in the yarn and re-tie broken ends automatically. This can be achieved by the installation of a complete knotting mechanism for each individual winding head. The knotter unit, however, is the most complicated and sensitive part of the machine. The number of failures on such automatic winders is unnecessarily high, and therefore requires constant maintenance, so that the installation does not actually justify the slightly higher production which might be obtained under some circumstances.

Messrs. Schlafhorst claim to have overcome this disadvantage with their Autoconer, which has one knotter carriage for every ten spindles. The knotter carriage shuttles to and fro, stopping only when required, that is when the spinning or twisted cop is empty, or when a yarn break occurs. This arrangement causes the time that each winding head has to wait for attendance to be minimised and yet all the advantages of an automatic winder, with a knotter to every winding head, are fully maintained, but with much less mechanical effort.

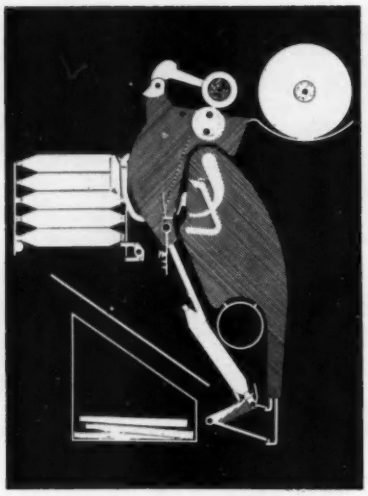
The main task of an operator attending to an automatic winder is inserting full spinning or twisting cops. Each winding head has an individual magazine, storing 5-7 cops, depending upon their diameter. Therefore, the operator re-fills the magazines under no pressure of time and has to move about much less for servicing such a machine than she would be required to on one having single pockets or spindles.

The magazine can be adjusted to different cop dimensions within seconds by a few simple manipulations. The operator slides the yarn end from the spinning or twisting cop effortlessly over a guide as she places it in the magazine, where the yarn positions itself, is held fast and the excess yarn end is cut off. Each time the knotter carriage stops at

This latest Schlafhorst machine has a travelling knotter to operate when the supply package is empty or a yarn breaks



The pusher in the knotting head in the act of tying the two single knots of the fisherman's knot together



Cross-section showing the path of the yarn, also how the new cop slides on to the spindle

a winding head to perform an operation a nozzle is opened for a brief moment and a vacuum stream tightens the yarn. This measure ensures an economy in expensive vacuum air, but still guarantees that the tail of yarn coming off the cop is always tightened, even when the cop is lowered in the magazine. The tail of the lowest cop in the magazine is positioned in such a way that the suction arm of the knotter carriage can pick it up securely at the cop change.

At a cop change, the spinning or twisting cop slides down on to a self-adapting spindle, where it is kept firm by a spring loaded lever. Each spindle can take, without any adjustment being necessary tubes with an inside diameter ranging from $\frac{15}{64}$ to $\frac{19}{32}$ in. or $\frac{19}{32}$ to $1\frac{11}{32}$ in. This ensures the cops are always positioned correctly for running-off. The machine is designed to handle all spinning and twisting cops on hard paper tubes, with an overall length ranging from $7\frac{25}{64}$ to $11\frac{13}{16}$ in. The outside diameter of the yarn body may be from $1\frac{1}{16}$ to $2\frac{9}{16}$ in., the changeover to other cop dimensions requiring only seconds.

From the spinning cop, the yarn passes through the tubular unwinding accelerator, which has proved so very satisfactory on the BKN and IKN manual winders. It ensures that no loops are carried up by the thread when unwinding at high speeds. Thus the yarn can be wound at higher speeds and with less yarn breaks than formerly. In addition to this the density of the package is more uniform, which is particularly essential for dye packages.

On leaving the unwinding accelerator, the yarn enters the tension device, guided through a wear-resistant eyelet. First it goes through a yarn clearer which strips off all loose material such as seeds, leaves etc. without causing a yarn break. The width of this pre-clearer may be set by each mill according to their yarns. The adjusted widths can be easily checked on a coloured scale. The setting itself is done with a special key, so that any unauthorised alterations are almost impossible.

Before the yarn enters the tension device it passes the thread detector, which consists of two feeler forks. While the yarn runs, the detector does not touch it. When a yarn break occurs at the tension device or main clearer, the forks feel the yarn, but due to the presence of the yarn tail they cannot mesh as the yarn still remains in the area of the thread detector. The knotter carriage then re-ties the broken ends. When the supply cop is empty, no yarn remains between the two forks so they mesh, in which case the knotter carriage causes a cop change.

Tension Arrangements

The tension device, or yarn brake, is fitted above the thread detector. One side of it is a positively driven disc and the other is a spring loaded shoe. Due to the fact that the disc is positively driven it is ensured that no dust, fluff or fly can collect on the tension device, so that the initial tension remains constant. The setting of the tension is easily adjusted and can be checked on a quarter circle coloured scale.

Following the yarn path, the main clearer is positioned immediately after and above the tension device. This also is adjustable by a special key and eliminates un-authorised alteration. Here, too, a coloured scale allows a quick control of the setting.

Immediately above the clearer there is a suction pipe which absorbs and removes

After doffing a full package, the operative places it in a tray before fitting an empty core in the cradle

any dust, fluff or fly, for, especially on the clearer, any collection of dust etc. would cause interference.

The circumference of the yarn guide drum drives the package, while the groove itself traverses the yarn. The varying depth of the groove ensures an effective tension compensation all over the stroke. As soon as the pre-determined package diameter has been reached, the winding head gives a signal to the operator by dis-engaging two push-buttons. One push-button is on top of the machine immediately beside the package, and the other at the front of the winding head, above the function control light. The accuracy of this device is within plus or minus $\frac{1}{32}$ in. In this way, an effective length measurement of the thread on the cone or cheese is achieved.

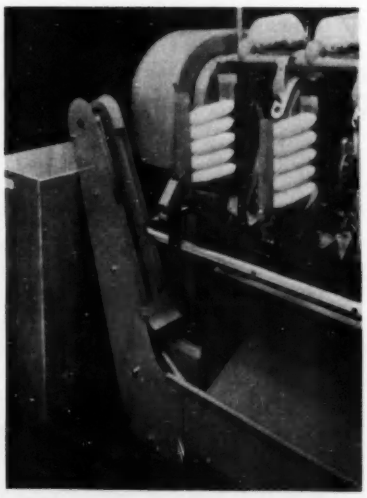
By a few simple movements the operator can take off the full package, place it in a tray provided on the machine, and fit an empty core into the cradle. The operator then breaks the yarn off the full package and just lays it over the new core, and after the engaging button is depressed, the winding head re-starts.

On the Autoconer the package keeps in contact with the yarn guide drum during the entire winding cycle. If a yarn break occurs, or if the cop is empty, the yarn guide drum and package are gently stopped together. This is possible because each winding head is driven independently by an intermediate roller.

Each winding head is fitted with a torsion spring which compensates the increasing weight of the package as it builds up. This is achieved by varying the lever arm while the force of the torsion spring remains practically even. The relieving pressure of the torsion spring on the package cradle is infinitely adjustable and the setting can be checked on a scale. In this way any desired package density can be achieved. There is an oil level indicator for the hydraulic package-cradle vibration-damper just below the cradle relief scale. A rod connects the damping piston to the package cradle. The oil in the damping cylinder ensures smooth and vibration-free running of the package.

By pulling out or depressing the engaging knob, the winder head can be stopped or started. A signal light is fitted just below the engaging knob on the front of the machine on each winding head. Every time the knotter carriage performs an operation, a coil heats a bi-metallic strip inside each winding head. It might be possible that, due to an excessively high yarn breakage rate, or due to mechanical failures, the knotter carriage stops frequently at one spindle. In this case, the bi-metallic strip is heated to such an extent that it causes the winding head to stop automatically. The light of the automatic function controller signals to the operator immediately she is required to attend to it. Naturally the coil and bi-metallic strip never reach temperatures which might cause danger of fire.

The temperature at which the winding head is dis-engaged can be regulated. With this automatic function controller, the machine does not merely check the



Ejected empty tubes pass along an elevator at the side of the machine for collection in a large container. If required they can be collected in boxes underneath each spindle

mechanical function of the elements itself, but simultaneously checks the quality of the yarn. For example, should a very bad spinning cop cause excessive yarn breaks on one winding head, this winding head automatically cuts out. The operator takes out the bad spinning cop and any unnecessary stoppages during the following processes, and second quality cloth, are eliminated.

The packages of the Autoconer are wound with a lateral yarn displacement motion which can be adjusted to three different amplitudes. The density of the yarn body on the edges of the package can be effectively controlled, which is very important for dyeing packages. At each yarn break an adjustable lever checks the lower end of the spinning cop and assesses the amount of yarn remaining on the cop.

This lever can be adjusted in such a way that in case of a yarn break in the bottom winds of a cop, the tube containing a small amount of yarn is exchanged automatically for a new cop. In this way, the bottom winds which occasionally are of poor quality are ejected, thus avoiding two knots within a short yarn length. The ejected empty tubes can be collected either into individual boxes beneath each spindle, or on a conveyor belt. At the end of the conveyor belt is an elevator so that the tubes can be dropped into a large container.

The winding speed is infinitely variable from 750 to 1,300 yds./min. by means of a hand wheel. This enables each mill to wind its yarn economically and with a maximum output. The knotter carriage has its own drive and travels continuously to and fro inside the machine. The travelling time from one winding head to the next is one second. The compact knotter carriage runs inside the frame so that the operator is not hindered when changing cones.

As soon as the cop is emptied, or if a yarn break occurs, the knotter carriage stops at that winding head. The intermediate roller contacts the reversing shaft and turns the yarn guide drum backwards together with the package. Simultaneously the upper suction arm picks up the end from the package while the lower suction arm picks up either the broken end from the tension device, or the yarn tail from a fresh spinning or twisting cop. The two suction arms then bring both tails together. During this motion, the end coming from the cop is threaded into the pre-clearer, thread detector, tension device and main clearer.

The knotter carriage opens all these elements so that the thread is positioned without any strain. Both ends are placed parallel into the knotter carriage, and contrary to the well-known hand-knotters, both tails are inserted countercurrent into the knotter head. The knotting bills of the rugged machine knotter take the ends and make the loops for a fisherman's knot and at the same time, the knives of the knotting bills cut the tails short. A pusher ties the two single knots firmly together and also checks the durability of the knot. After this operation, the knotter head surrenders the thread for spooling.

A fan arranged in the end frame of the machine collects the yarn tails, cut off by the knotter, on a filter screen. These tails can be removed easily from the filter chamber. The sturdy machine knotter is equipped with a counter which registers the number of knots. Another counter registers the number of full spinning or twisting cops fed. This enables each mill to check the production easily and to estimate the average length of yarn without a knot. A counter on the driving frame registers the working hours, which is useful for production and efficiency calculations. This arrangement also indicates the correct times when the machine has to be lubricated according to the schedule.

The Autoconer is equipped with a new type dust extracting plant, which is extremely effective. An overhead travelling blower cleans the winding heads and the yarn. One exhauster beneath every two winding heads continuously absorbs a large volume of air at low speed. Therefore all fluff, fly and dust is sucked down to the bottom and collected on a filter screen. When a lever is pushed, the accumulated fly and dust from a section of ten spindles is mechanically stripped off in the form of a fleece.

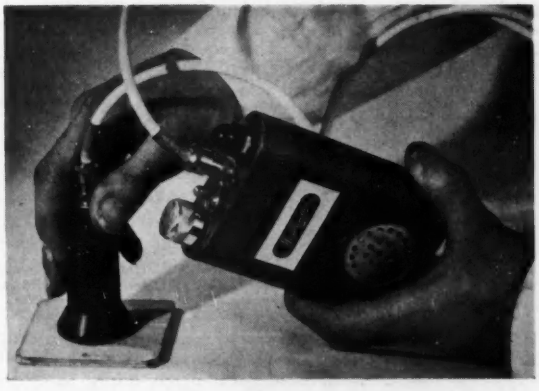
The standard unit has ten winding heads with one knotter carriage. It can be assembled into machines of 10-, 20-, 30-, 40- or 50-spindles having one driving frame and one end frame containing a filter for the yarn tails. In any case, however, for every ten spindles it will have a separate knotter carriage. The Autoconer winds standard cotton, wool, staple rayon and blends. It winds spinning or twisting cops off hard paper tubes into hard and soft cylindrical or conical packages. The stroke of the package can be either 3¼, 5, or 6 in. Naturally, for changing from one traverse to another, some parts must be exchanged such as the yarn guide drum, the upper suction arm of the knotter carriage, and possibly the package cradle. Accelerated-taper hosiery cones can be wound with a 6 in. traverse.

All shapes of packages with the exception of hosiery cones can be wound into soft packages for dyeing. B. L. Engineering Ltd., Stamford Street, Ashton-u-Lyne, are the U.K. agents for W. Schlaforst and Co.

New Metallisation Thickness Gauge

WITH the extensive present day use of the metal spraying process for the protection of steel structures the question of inspection and quality control becomes more urgent. Because thickness is an important part in the protective value of sprayed metal coatings it is essential that this should be adequately checked. A new type of measuring instrument recently introduced by Metallisation Ltd., Barclays Bank Chambers, Dudley, Worcs, goes a long way to reducing the problem. This instrument, which has been designed specifically for sprayed zinc and aluminium coatings, enables large areas to be checked rapidly.

The principle of its operation is based upon an exploring head which may be moved quickly over the coated surface. The instrument having been set to indicate a minimum thickness gives an audible warning of areas which are below the required thickness. Accurate test specimens are used to set the gauge to any desired thickness between 0·002″ to 0·012″. The set is completely portable, fully transistorised and the miniature operational battery has a life of over four months. It is stated to be unaffected by magnetic fields or stray magnetism. Whilst the exploring head is designed for flat surfaces adaptors are being designed to enable the unit to measure curved surfaces and tubes.



Completely portable and fully transistorised, this instrument has been designed specifically to check sprayed coatings of zinc or aluminium

Removing Waste from Spent Tubes

IN most spinning and manufacturing sections of the industry, pirn, bobbin and tube stripping has always been regarded as an irksome but extremely important operation. Getting the right sort of labour for this work has never been easy and the situation at present is undoubtedly worse. Busier conditions in running mills with evening and double shift considerations has tended to aggravate the problem of tube stripping. It is, therefore, timely to give brief details of a new cheese tube stripper recently introduced by H. Slater and Son (Engineers) Ltd., Surrey Works, Broadfield Road, Sheffield 8.

As will be observed from the illustration, it is a robustly-constructed, semi-automatic unit which is operated pneumatically at 80 lbs./sq. in. The operative, feeding the tubes by hand, merely presses a button for each operation which, normally, takes approximately 4 to 5 secs. The makers state that one girl operative should be able to attend to between 6- and 7,000 tubes per day; incidentally, rotating knives are employed for cutting. Fully motorised for 400 volt, 3-phase, 50-cycle supply, the machine is complete with starter and guards, etc.

Continuous Level Indicator and Controller

A NEW instrument, known as the "Levelrator," is announced by Thomas Industrial Automation Ltd., Station Buildings, Altrincham, Ches. Designed to give continuous indication of the contents of tanks, hoppers, etc., it will also operate visual and/or audible alarms. The equipment uses one electrode only for both continuous measurement and control. Alarm points can be set to operate over the full length of the electrode to suit the particular application. The electrode system can be the rigid variety for a small vessel and the flexible type when the depth of the container exceeds 6 ft. Limitation of length of electrode is really dependent upon the particular application, but electrodes are available up to 60 ft. in length.

Control Points

The high or low level control points are independent of the indicating instrument, and the relays are operated by a specially designed electronic circuit. This equipment is claimed to be virtually unaffected by normal mains and temperature fluctuations. The control unit consisting of a stabilised power supply, alarm relay circuits and built-in calibrating instruments is housed in a specially designed cast iron or sheet steel weatherproof case in first-grade industrial finish and can be situated up to 150 ft. from electrode head unit. Remote indicators can be supplied to customers' requirements, and sited anywhere on the plant. The "Levelrator" can be supplied in multi-point units and meters can be supplied for fixing to existing panels and control desks.

(left) The "Levelrator" can be supplied in multi-point units

Handling Problem Overcome

An entirely new system of carpet handling and storage was devised by James Templeton and Co. Ltd., Bridgeton, Glasgow, when they introduced a new range of broadloom goods. Dexion slotted angle forms the basis of the installation, which occupies some 57,000 cu. ft. and can accommodate nearly four hundred of these normally unwieldy rolls.

Each roll, weighing anything up to 800 lbs. is stored on a pallet, which in turn rests on its own Dexion Glidewheel conveyor track. A specially adapted fork-lift truck serves the whole installation at all levels. As lengths are ordered, the required roll is pushed out, complete with pallet, on to the roller arm of the truck and taken away for cutting. The roll is then returned to its rack in the same effortless manner.

(right) This photograph shows a roll of broadloom carpeting leaving the Dexion racking for cutting

THE TEXTILE
COLOURIST & FINISHER

New Facts About Some New and Old Fibres

Much more information is now available concerning the characteristics and properties of some of the newer synthetic fibres, and the author reviews developments in both man-made and natural types

By B. C. M. DORSET

IN recent times not only have several new fibres been discovered but a considerable amount of new information has also been released concerning them. It is worth noting too that useful knowledge has been disclosed in relation to various textile fibres both new and old with a view to assisting their utilisation in various fields but particularly for textile purposes.

The first fibre for discussion is a new type of Arnel to be known as Arnel 60, made by Celanese Corporation of America. Both Arnel and Arnel 60 are cellulose triacetate fibres having an acetyl content of 60 to 62% compared with the 54% for ordinary acetate fibres.

Arnel has been found to have several advantages. It has a high resistance to saponification and to delustring, a high melting point (about 300°C. compared with a melting and decomposition temperature of 225 to 250°C.), and lower susceptibility to degradation by sunlight; in addition, it can be given a high temperature treatment (around 220 to 240°C. for 10 to 20 secs.) by which several of its properties can be improved. Yet among the synthetic fibres Arnel has the low dry and wet tensile strengths of 1·2 and 0·8 grams/den. respectively. It was for this reason that American Celanese chemists sought means for raising the tensile strength of Arnel and have now succeeded in doing so by almost 60% and by nearly 90% in respect of the wet tensile strength. It is this Arnel with improved properties which is now known as Arnel 60.

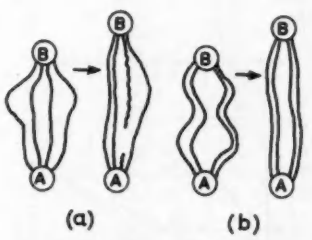


Fig. 1. Showing how groups each of four molecules within a fibre and whose ends are fixed at points A and B contribute to the fibre strength during its extension. In (a) one short molecule takes the strain before the others and breaks, while in (b) all four are of equal length and all take the strain together. Thus (a) represents a molecular arrangement which gives a weak fibre while (b) gives a stronger fibre

Sprague (J. Text. Res., 1960, **30**, 697) recently disclosed the guiding principle of the research which led to the discovery of Arnel 60. It is believed that in a fibre of ordinary Arnel the long chain molecules are not all the same length and that some are short and others long. This difference has a definite influence on the strength of the fibre. It is also believed that apart from the length of the molecules the tensile strength of a fibre can be influenced by their straightness, and the manner in which they can become fixed at spaced intervals along their length. Fig. 1*a* shows a group of four molecules fixed at points *A* and *B* within a fibre and it is to be noted that neither molecule is straight so that their lengths between the fixed points differ. If now the fibre is subjected to a length stretching these molecules will become straighter until with the fixed points *A* and *B* further apart one of the molecules will have become straight whilst the others have not. At this stage in the stretching any further stretching will cause the strain to be taken entirely by this straight fibre. It is obvious

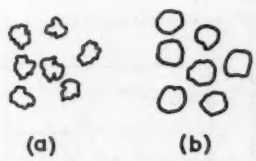


Fig. 2. Cross-sections of (a) Arnel and (b) Arnel 60

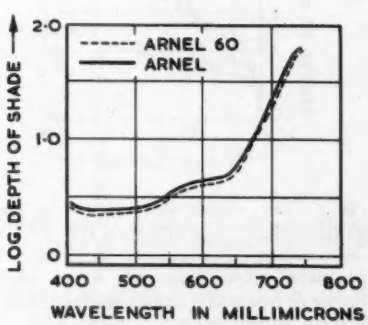


Fig. 3. Nearly coincident curves for Arnel 60 and Arnel, showing the spectro-photometric measurement of the depth and tone of shades produced on the two types of triacetate fibres in dyeing with a brown mixture of dyes are equal

that this state of affairs does not lead to a high strength fibre since it is one in which only a minor proportion of the molecules are taking the strain at any one time—it would be much better for all the molecules to have the same length between points *A* and *B* as shown in Fig. 1*b* so that in the stretched state all four molecules simultaneously become straight and together take the strain thus making the fibre much stronger. By special modification of the manufacturing process it has proved possible to produce Arnel 60 fibres which have this special molecular structure.

Obviously, it is interesting to know how far the properties of Arnel 60 compare with those of Arnel and Sprague has given much useful information on this point.

Microscopic examination reveals two differences. Firstly the surface of Arnel 60 fibres is rough so that the fibres have a semi-dull appearance due to an irregular reflection of light rather than to the presence of an opaque pigment. Secondly the fibre cross section is circular and not indented as shown in Fig. 2. The high surface roughness is useful in-so-far as it gives improved fibre adhesion valuable in carding, drawing and spinning. The indented cross section favours the absorption of dyes since a larger surface area assists dye absorption, and it is found that Arnel 60 has much the same dyeing properties as ordinary Arnel. Both Arnel 60 and Arnel respond similarly to the use of dye-carriers in the dye-bath and the shades obtained on both fibres have the same fastness properties. The close similarity of dyeing properties of the two types of Arnel fibre is clearly shown by the dye absorption curves shown in Fig. 3 obtained from the dyeing of these fibres together with a mixture of dyes used to produce a brown shade.

In Table 1, the physical properties of Arnel 60 are tabulated against those of Arnel, ordinary viscose rayon, and a high tenacity viscose viscose rayon (Fibre 40).

Table 1

Property	Arnel 60	Arnel	Ordinary viscose rayon	Fibre 40
Dry tenacity	2·1 g./den.	1·2	2·7	3·0
Wet tenacity	1·5 g./den.	0·8	1·4	2·0
Elongation				
Dry	25·0%	34·0	21·0	9·0
Wet	36·0%	45·0	24·0	10·0
Stress required to produce elongation of 1% (initial modulus)				
Dry	1·0 g./den.	0·7	0·8	1·3
Wet	0·5 g./den.	0·3	—	—

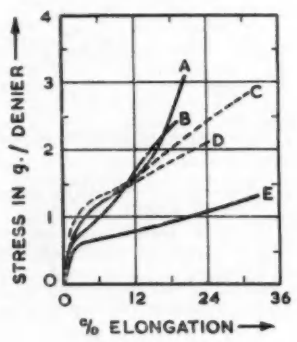


Fig. 4. Dry stress-strain relationships for (A) Dacron 54, (B) ordinary viscose rayon, (C) Orlon 42, (D) Arnel 60, and (E) Arnel

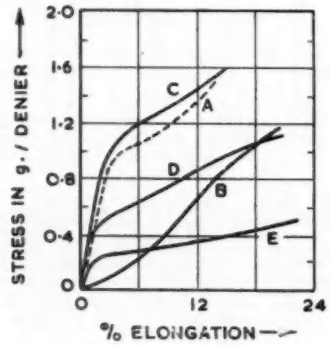


Fig. 5. Wet stress strain relationships for (A) Dacron 54, (B) ordinary viscose rayon, (C) Orlon 42, (D) Arnel 60 and (E) Arnel

The dry stress/strain relationship for Arnel 60 in comparison with other fibres is shown in Fig. 4. It is to be noted that Arnel 60 has quite good resistance to excessive stretching when exposed to relatively small stresses such as may be experienced by yarn during winding, weaving and knitting operations. After a heat treatment at 215°C. for 2 mins. Arnel 60 fibres have an increased resistance to stretching forces whereas Arnel fibres are changed so as to stretch more easily.

The moisture regain of Arnel 60 under standard conditions is 4·2% but this is reduced to 3·3% by the heat treatment mentioned above. Its water of imbibition values before and after heat treatment are 18·5% and 16·8% respectively. Fabrics made with Arnel 60 have good wash-and-wear characteristics. It is useful to compare the stress-strain curves for Arnel 60 and other fibres in their dry state as shown in Fig. 4 with those which hold similarly for the same fibres when wet and as shown in Fig. 5. The comparison indicates that Arnel 60 woven and knitted materials might be expected to give good resistance to moist or wet creasing without the necessity for applying a resin treatment.

All synthetic fibre materials are subject to discolouration during everyday use and especially if exposed to light containing ultra-violet rays—colour development arises from chemical decomposition of the fibres. To overcome this defect much investigation has been carried out with a view to incorporating in such fibres either stabilising chemicals or the fluorescent whitening agents which are now widely used by bleachers and finishers of most kinds of textile materials. Success with the latter type of substance has resulted in the recent introduction (Mod. Textiles; 1960, Oct., *p.* 37) of an Enka Blanc de Blanc's brand of nylon yarn for use in foundation garments and girdle fabrics with other potential uses—it is characterised in having an exceptional pure whiteness obtained by incorporating in the nylon polymer (before fibre spinning) a suitable fluorescent whitening agent. The particular agent chosen is fast to washing so that materials made with the Blanc de Blanc's yarn can be repeatedly washed without loss of original whiteness.

The increased whiteness is not affected by ordinary artificial fluorescent lighting but it can be seriously reduced by exposure to sunlight or other form of illumination which contains a high proportion of ultra-violet light. It has been checked that the presence of this fluorescent whitening agent in the nylon yarn does not affect its other physical properties such as strength and extensibility, its softening temperature and heat-setting characteristics. Thus Blanc de Blanc's yarn has a breaking strength of 4·9 g. per denier and an extension at break of 37%; it shrinks 11·8% in boiling water. On the other hand, whereas ordinary Enka nylon yarn has a faint yellow tone, the Blanc de Blanc's yarn is bluish white.

Shrink-Resistant Fabrics

In the production of shrink-resistant fabrics consisting of re-generated cel-

lulose fibres such as viscose rayon it has been noticed that in using a compressive shrinkage method greater difficulty is experienced with such fabrics than those containing cotton. Firstly, it is generally necessary to close-up in the warp a viscose rayon fabric to a much greater degree than it is with a cotton fabric. Secondly, if the rayon fabric is closed-up it may shrink (though to a less extent) during subsequent repeated washing. The conclusion reached is that to produce satisfactory shrink-resistant rayon fabrics either these must at some suitable stage be given dimensional stability by a resin treatment or in some special way the rayon fibres should be manufactured so as more closely to resemble cotton in those properties likely to affect washing shrinkability.

If the first modification is adopted the difficulty met with is that resins applied to both cotton and rayon fabrics are not absolutely fast to washing so that by repeated washing they become removed and their beneficial effect is ultimately lost. It thus appears that the best solution of the shrinkage difficulty is that of manufacturing rayon fibres having cotton-like properties.

General experience in the production of shrink-resistant cellulose fibres has shown that the main property associated with washing shrinkage is their initial wet modulus, that is, the stretching force necessary to apply to produce a moderate degree of extension say up to 2 to 3%. In the case of cotton this initial modulus expressed as grams per denier required to produce an extension of 1% is much higher than for ordinary viscose rayon (it may be 10 to 12 times greater). Otherwise stated, in the wet state viscose rayon fibres are very much more easily stretched than are cotton fibres. Thus in the wet processing of viscose rayon fabrics where they pass through numerous types of machines such as mangles and over drying cylinders they suffer such a high degree of stretching that it is difficult by means of compressive shrinkage to bring them back to their unstretched dimensions. Also in home washing of compressively shrunk viscose rayon fabrics and garments it is comparatively easy to extend them and so produce loss of shape.

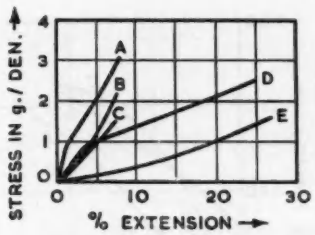


Fig. 6. Stress-strain curves for (A) dry SM.27, (B) wet SM.27, (C) cotton, (D) viscose rayon dry and (E) viscose rayon wet

Recently Lund and Wharton (J. Tex. Res., 1960, **30**, 692) have described a new type of viscose rayon staple fibre which is termed SM.27/SC.28 and is made by Courtaulds (Albama) Inc. Its manufacture is expressly devised so that it has extensibility properties closely resembling those of cotton and thus merits the description of being termed a high-modulus rayon fibre. In Table 2 its properties are tabulated so as to compare SM.27 with viscose staple and cotton fibres.

Table 2

Property	SM.27	"Fibro"	Cotton
Dry tenacity (g./den.)	3.0 to 3·4	2·5	2 to 3
Wet tenacity (g./den.)	2·1 to 2·5	1·4	2 to 3
Dry extension at break, %	7	18	5 to 7
Dry fibre elastic recovery, %	50	40	50
Stress (g./den.) to produce 5% extension—Wet	1·2	0·1	1·2

These data show the new high-modulus viscose rayon fibres to be stronger than those of cotton but to have about the same initial wet modulus; at the same time they are very much superior to ordinary Fibro fibres in wet and dry strengths and particularly so in respect of their initial wet moduli. These differences can also be clearly seen from the curves in Fig. 6 which illustrate the susceptibilities of the three fibres to stretching under both dry and wet conditions over a wide range of extension.

SM. Fabrics

The new SM. viscose rayon fibre consists of pure cellulose and is thus most probably produced by the introduction during manufacture of special stretching treatments. It can be processed in enzyme de-sizing, scouring, dyeing and bleaching in much the same way as cotton goods and experience has so far indicated that SM. woven fabrics can be wet processed by continuous methods such as are employed for dyeing and bleaching purposes yet resist excessive lengthening so as to allow their final satisfactory shrink-resist finishing by a compressive shrinkage method.

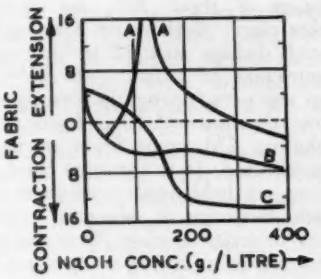


Fig. 7. Length changes in (A) "Fibro", (B) SM.27 and (C) cotton fabrics as produced by treatment with caustic soda solutions of various concentrations

SM. viscose rayon is not however identical with cotton in several of its properties and it is thus useful to note some of these differences. At the same time its differences from ordinary "Fibro" can be pointed out.

It is now generally recognised that in finishing rayon fabrics so as to have wash-and-wear properties it is advantageous to pre-treat the fabric with a dilute caustic soda solution and thus pre-swell the fibres—this gives the fabric increased power to shed any creases in a wetting treatment which may have formed during the use of the fabric in its dry state. Such swelling of the fibres will normally precede the ordinary resin treatment to give dry crease resistance to the rayon fabric. How does SM. rayon respond to such pre-swelling treatment in comparison with ordinary viscose rayon fibres?

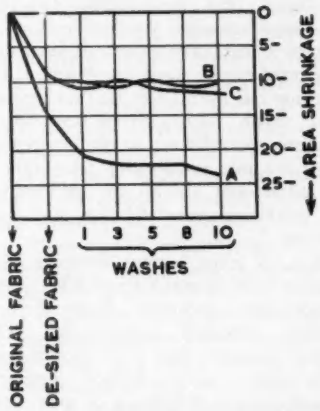


Fig. 8. Curves showing the area shrinkages of similar (A) "Fibro," (B) S.M. 27 and (C) cotton fabrics in desizing and repeated washings

It is well known that when ordinary viscose fibres are immersed without tension in aqueous caustic soda solutions of increasing concentration the fibre swells excessively when the concentration is about 12 to 14% but thereafter is less until at a concen-

tration of about 30% no swelling takes place. Such rayon fibres suffer much damage with 12 to 14% concentrations of caustic soda and this can also occur during the washing-out from the fibres of 30% caustic soda solution. SM. rayon fibres are much less affected. If on the other hand the fibres are held under tension during such treatment it becomes evident that ordinary viscose fibres become very ductile so as very easily to extend in length with caustic soda solutions of 12 to 14%. Lund and Wharton have recorded data represented by the curves in Fig. 7 in which cotton, Fibro and SM. rayon fabrics were treated with caustic soda solution while tensioned with 200 grams/in. width of fabric—the curves show how SM. rayon closely resembles cotton while differing from ordinary "Fibro" in such treatment.

SM rayon fabrics can thus be mercerised similarly to cotton fabrics without requiring the close and careful control of the conditions of mercerising which is essential with ordinary viscose rayon fabrics to avoid damage to these. SM rayon fabrics can thus be satisfactorily pre-swelled as a useful preliminary treatment for ordinary resin crease resist finishing. It is a curious but useful fact that mercerised SM rayon fabrics have any seams present specially set so that thereafter they do not unravel in use—this is an additional aid to the production of wash-and-wear fabrics and garments.

Fig. 8 gives curves showing how similar fabrics made from SM rayon, cotton and ordinary Fibro behave during repeated laundering. The curves indicate that while cotton and SM rayon fabrics behave similarly in suffering a shrinkage of only 10% after ten washings the ordinary Fibro fabric shrinks nearly 25% under these same conditions.

It has been observed by Lund and Wharton that most rayon fabrics in the form of curtains and other hung draperies increase in length according to their weight and to the humidity of the surrounding air. On the other hand, curtains made from SM rayon have this effect only to a minimum degree because the SM rayon fibres are less extensible than ordinary rayon fibres in a damp condition and also because they require a higher force to stretch them.

Mention has been made above to the fact that quite good resistance to dry-creasing can be obtained by applying to SM rayon fabric a urea-formaldehyde or similar resin in the usual way, but it must be pointed out that this new type of rayon will, like cotton, require a lower proportion of resin than ordinary viscose rayon. The explanation of this lies in the fact that the SM rayon fibres have a molecular distribution more oriented and perhaps more crystalline. Comparison of the amounts of resin required in the crease-resist finishing of the three types of fibre fabrics can be made by reference to the curves in Fig. 9.

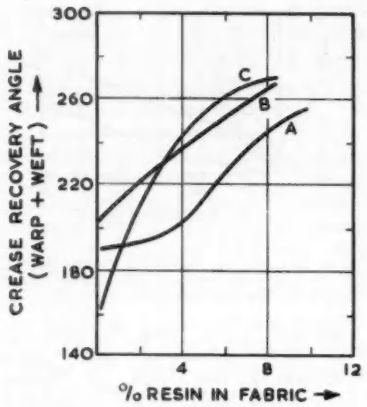


Fig. 9. Curves showing how the crease recovery values of resin-treated fabrics (A) "Fibro," (B) SM.27 and (C) cotton vary with the amount of resin present

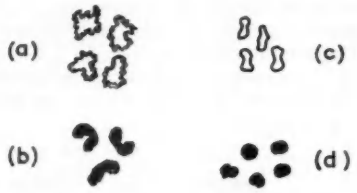


Fig. 10. Cross-sections of (a) ordinary tyre cord viscose fibre (b) all-skin type of tyre cord rayon (c) ordinary cotton and (d) mercerised cotton as stained by Procion Black HGS to show the extent of the "skin"

New Staining Method

A new method which shows the magnitude of the "skin" part of a viscose rayon fibre has been devised by Kato (J. Tex. Res., 1959, **29**, 661). It makes use of the reactive dye Procion Black HGS and is interesting in that when applied to a viscose rayon fibre it directly colours the skin without staining the inner core—in previous tests of this kind in which a dye solution is employed it is usual for both skin and core to be initially stained but in a subsequent washing treatment the dye leaves either the skin or the core to allow them to be distinguished from each other.

The test is carried out in the following manner. Firstly a staining solution is prepared by dissolving 10 g. of Procion Black HGS (I.C.I.) and 7 g. of urea in a small amount of hot water. After cooling an addition of 2 g. of soda ash is made and the solution is diluted to 100 c.c. This staining solution is stable at room temperature for several weeks.

Cross sections of the fibres under examination are prepared by the standard paraffin wax embedding method and are cut to 5μ thick (μ=0·00001 cm.). They are mounted on a glass slide and there flooded with the above dye solution and then heated gently on a hot plate for several minutes, taking care not to allow the dye solution to dry. The dye solution is then rinsed off from the slide with water. At this stage the skin portion of each fibre cross section is found to be stained and the extent of this staining can then be observed under a microscope.

A test of this kind can be most useful since today there is a trend to manufacture viscose rayon fibres having a large proportion of skin—some types are practically all-skin It has been found that viscose rayon for use in the reinforcement of motor tyres has the most suitable properties for this purpose if it is largely of the all- or nearly all- skin type since the skin contributes most of the strength of the fibre and also controls the fibre extensibility.

In Fig. 10 are shown cross sections of fibres taken from a typical tyre cord rayon—some have a moderate proportion of skin while others have all-skin. Also shown are cross sections of mercerised and non-mercerised cotton fibres for it has been found that the Procion Black HGS is also useful for distinguishing between these two types of cotton.

Of considerable importance is the present day interest being taken in nylon 6 as distinct from nylon 6,6. It is believed that about thirty large scale plants are now producing nylon 6 and it is significant that this type of nylon is now being manufactured in America which is the home of nylon 6,6. Much nylon 6 is being used in preference to nylon 6,6 for the knitting of ladies nylon hose

$$---NH(CH_2)_6NH-CO(CH_2)_4CO-NH(CH_2)_6NH-CO(CH_2)_4CO-NH(CH_2)_6NH---$$

Fig. 11

$$---NH(CH_2)_5CO-NH(CH_2)_5CO-NH(CH_2)_5CO-NH(CH_2)_5CO---$$

Fig. 12

$$n\,NH_2CH_2CH_2CH_2CH_2COOH \rightleftharpoons H[NH-(CH_2)_5CO]_nOH + nH_2C$$

ω-amino caproic acid

Fig. 13

and it is variously reported that it is also finding considerable use in motor tyres in competition with nylon 6,6. The most important American made nylon 6 is being marketed as Caprolan (Allied Chemical Corporation).

Nesty (J. Tex. Res., 1959, **29**, 763) has recently given useful information concerning the properties of Caprolan which shows how this type of fibre has been improved in recent years and how it can compete with nylon 6,6.

In the first place it is necessary to note the essential distinction between these two types of polyamide fibres from the viewpoint of their manufacture. Nylon 6,6 which is the type of nylon originally pioneered by the E. I. du Pont de Nemours Company in America is made from the polymer polyhexamethylene adipamide which in its turn is made by polycondensation of an equimolecular mixture of hexamethylene diamine and adipic acid so that the fibres consist of long chain molecules represented by the formula Fig. 11.

Nylon 6 was pioneered in Germany during the last world war and is made from polycaprolactam which in its turn is made by polycondensation of caprolactam (the anhydride of ω-amino-caproic acid) so that the fibres consist of long chain molecules represented by the formula Fig. 12.

The two types of polyamide fibres have similar properties but are clearly distinguished by their melting points—nylon 6 melts at 212 to 220°C. while nylon 6,6 melts at about 250°C. Both types are regularly produced to have a dry tensile strength of about 4·5 g./den. (higher and lower strength fibres are made by modification in the usual stretching stage) and they have the same moisture regains of 4·5% under standard conditions and the same density of 1·14.

In the early days of nylon 6 manufacture the fibres were inferior in strength and other charateristics to nylon 6,6 fibres mainly because of a peculiar difficulty encountered in the manufacture of the fibre-forming polycaprolactam. This polymer is formed by heating caprolactam, but under the conditions employed the polymerisation reaction (Fig. 13) is reversible and so there can be left in the polycaprolactam about 5 to 6% of unchanged caprolactam. Although this impurity can be removed it is found that a fresh amount will form in the fibre spinning stage which involves a high temperature melt extrusion method. The presence of this impurity in the resulting fibres lowers their quality. It is only more recently that satisfactory means have been found for avoiding this difficulty so that the nylon 6 now being produced has a higher quality more acceptable to textile manufacturers and thus allows nylon 6 more effectively to compete with nylon 6,6. The present method for manufacturing Caprolan allows fibres to be produced containing less than 1·5% of unchanged caprolactam. However, not all the improvements associated with modern nylon 6 fibres are attributable to the use of a purer fibre-forming polycaprolactam—many improvements come from newly discovered means for improving the fibres by heat, stretching, and other treatments.

The properties of nylon 6 and nylon 6,6 fibres are largely governed by their degrees of crystallinity. It has now been found possible to produce high tenacity nylon 6 fibres (termed Caprolan HB) and the same fibre also heat stabilised (termed Caprolan HBT) and these have about the same degree of crystallinity, say 30%, as comparable nylon 6,6 fibres.

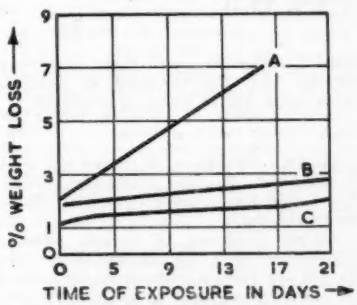


Fig. 14. Curves showing the weight loss (degradation) of (A) non-stabilised nylon 6,6. (B) heat-stabilised nylon 6,6 and (C) heat-stabilised nylon 6 while exposed at 150°C to hot air circulating in an oven

Nylon 6 yarns of the Caprolan type have proved very useful in motor tyres and also (in 6- and 19-denier filament forms) for the manufacture of carpets. These latter have been found just as resilient as carpets of wool yet much more durable and resistant to the abrasion caused by people walking over them. In a comparison of carpets made with wool, acrylic, and Caprolan fibres using the Stoll flat-abrasion testing machine it was found that to wear the carpet pile down to the backing fabric the number of rubbing cycles required were 8250 (wool), 17,158 (acrylic fibre) and 83,000 (Caprolan fibre).

Nylon 6 materials can be dyed with all the dyes now commonly applied to nylon 6,6 materials with certain differences. These are that nylon 6 fibres often show a higher dye saturation value so that deeper shades can be produced, and also that in the case of Caprolan goods these show a higher "strike" value than nylon 6,6. The strike value is an indication of the rapidity of initial absorption of dye when the textile material is first entered into the dyebath so it is evident that greater care has to be taken to secure an even initial exposure of nylon 6 materials to the dye liquor if level shades are to be obtained.

Both nylon 6 and nylon 6,6 fibres undergo degradation when exposed to high temperatures under dry or wet conditions. Because of this it is usual to apply a stabilising treatment to these fibres when they are to be used (in the form of yarn or fabric) to high temperature conditions. From the liability of polycaprolactam to decompose at a high temperature with formation of a small amount of monomer caprolactam it has generally been accepted that nylon 6 fibres are the less stable of the two types. Actually the manufacturers of Caprolan claim that by special stabilising treatments they are now able to produce a Caprolan HBT type of nylon 6 having equal stability to degradation at high temperatures possessed by corresponding nylon 6,6. The curves in Fig. 14 show how such degradation of the two types of nylon fibre compare as a result of holding them at 150°C. in an oven through which air is circulated—the valuable effect of a stabilising treatment is revealed while it is also shown that a nylon 6 fibre can be even less degraded under such conditions than a nylon 6,6 fibre.

Recently, interesting particulars of a new type of acetate fibre have been given by Takagi and Goldberg (Mod. Tex., 1960, April, p. 49). It is claimed to have a dry tensile strength and extensibility at break of about 2·5 g. per denier and 26% as compared with

1·4 g. per denier and 32% for ordinary acetate fibres. A further advantage is that the new acetate fibre (made in Japan and known as Alon) is much more resistant to high temperatures so that it presents no more problems than cotton in hot ironing.

Alon fibres are made by acetylating a special high tenacity type of viscose rayon (the fibres of this are practically all-skin) so that the resulting fibres have an acetyl content of about 50%. The acetylation is achieved by first saturating the viscose rayon fibres with a liquor containing a special metal salt catalyst, then drying, and leading the fibres continuously through a chamber in which hot vapours of acetic anhydride circulate to ensure a uniform acetylation. The next stage consists of washing and bleaching the resulting Alon fibres and recovering the catalyst and acetic anhydride as such or in the form of acetic acid.

It is an important feature of such a manufacturing process that in the acetylation the high degree of polymerisation of the cellulose in the high tenacity viscose rayon fibres is not appreciably lowered (the actual change is from 380 D.P. to 340 D.P.). Thus the Alon fibres are left with the same tenacity as the original viscose rayon fibres but because there is a weight increase due to combination between their cellulose content and the acetic anhydride the tensile strength is numerically lowered to 2·5 g./den. Such fibres are highly resistant to shrinkage in boiling water.

Alon fibres can be dyed with the same dyes as used for ordinary acetate fibres and the fastness of the resulting dyeings are also about the same. Azoic dyes are recommended for securing black, dark blue and red shades.

It would appear possible to apply the above acetylation process to rayon fabric instead of fibres and this point is being investigated.

Cellulose triacetate fibres as now being made have a relatively low tensile strength, say of the order of 1·3 g./den. accompanied by an extensibility at break of 25%. This compares unfavourably with say nylon fibres having a tensile strength of about 4·5 g./den. If the triacetate fibres are highly stretched during manufacture with a view to securing a higher tensile strength then the extensibility will be unduly decreased so as not to be acceptable. On the whole, the low strength triacetate fibres are quite serviceable when used in the form of continuous filament yarns but it is desirable that they should have a higher strength when employed in staple fibre form.

Progress towards the production of stronger triacetate fibres now appears possible following the recent discovery (B.P. 826,098 of the Celanese Corporation of America) that if the coagulation conditions in a wet process of spinning are suitably arranged fibre stretching can be employed to obtain a higher tensile strength without at the same time unduly lowering the fibre extensibility, and in fact it is possible to have such conditions that both fibre strength and fibre extensibility can be caused to increase simultaneously.

In the usual form of wet spinning triacetate fibres a spinning dope is prepared by dissolving about 25% of cellulose triacetate (acetyl value of 61% approx.) in a mixture of 90 parts of methylene chloride and 10 parts of methyl alcohol and then this is extruded into a mixture of methyl alcohol and methylene chloride of different proportions. It is now found that if the methylene chloride in the coagulating bath is above 40% and generally near to 50% then conditions of temperature and stretching can be determined by experiment which allow triacetate fibres to be obtained which have a tenacity above 2·0 g. per denier accompanied by a minimum extensibility of about 22%. For example, triacetate fibres having this high strength and extensibility can be obtained by extruding a cellulose triacetate solution at 25°C. into a methylene chloride-methyl alcohol mixture coagulating bath containing 51% of methylene chloride—if the stretching (draw-down ratio) is 7:1 then the fibres may have a tenacity of 2·3 to 3·0 g. / den.

Book Reviews

MODERN YARN PRODUCTION FROM MAN-MADE FIBRES (AND THEIR CONVERSION INTO FABRICS). Columbine Press, Old Colony House South King Street Manchester 2 (price 27s. 6d.).

This symposium is based on a course of post-graduate lectures given in 1959-60 at the Manchester College of Science and Technology augmented by additional contributions and edited by Mr. G. R. Wray, of that college. Much of the material is here published for the first time. Its appearance is opportune, having regard to the many new and highly specialized techniques which have been brought into use in recent years for tow-to-sliver conversion, direct spinning of filament tow and the production of specialty yarns by false twist, edge crimping air texturing and other methods. Two chapters describe the characteristics of these new yarns and their behaviour in knitting and weaving. Appropriate literature references accompany each chapter and there are lists of yarn and fibre trade marks and machines mentioned in the text. The authors of chapters are recognised authorities on their particular subjects and the standard of printing, illustration and indexing is excellent.

S.P.S.

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SOUTH AMERICAN HANDBOOK, 1961. Trade and Travel Publications Ltd., 14 Leadenhall Street London E.C.3 (price 10s. 6d.).

Ample evidence of sound editorial supervision and of co-operation with British and foreign authorities and sources of information are borne in this remarkably comprehensive publication, now in its 37th year of issue. It provides all that visitors, whether for business or pleasure, need know concerning external and internal travel and for comfortable living in the cities and cities within its provinces. Copious notes are given on climatic conditions, places of interest, entertainment and refreshment, together with much background information which can add to the traveller's interest and enjoyment. Indeed, for a very modest sum, the visitor can equip himself with a most valuable, time and moneysaving guide.

FACTS ABOUT MAN-MADE FIBRES. British Man-Made Fibres Federation, Bridgewater House, 58 Whitwotrh Street, Manchester 1. (free on application). The fourth edition of this very popular booklet remains similar to earlier editions, and while only minor revisions have been necessary to the descriptions of the various fibres, additions to the section on bulked and textured yarns have been included. Appearing first in 1956, with the training of retail sales staffs as its main objective, the booklet has wide appeal for virtually every section of the trade and has been particularly sought after by schools, domestic economy training colleges and all anxious to be up-to-date about the man-made fibres industry.

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COTTON QUALITY STUDY V. Resistance to Abrasion. J. P. McNally and F. A. McCord. National Cotton Council of America, Ring Building, 1200 - 18th. Street, N.W., Washington, D.C., U.S.A.

Reprinted from Textile Research Journal, this study discusses cotton's market potential through improved abrasion resistance, reviews technology related to abrasion resistance, and suggests research that might well contribute to increasing markets for cotton.

Textile Institute Conference

Bleaching Machinery

Bleaching was the subject of the second conference of the Textile Finishing Group of the Textile Institute held recently at Buxton. In all, five lectures were given: Bleaching (F. V. Davis, B.Sc., F.R.I.C., F.T.I.); Use of Solvents in Bleaching (N. F. Crowder, A.M.C.T., F.R.I.C., A.T.I.); Peroxide Bleaching (Dr. J. A. Gascoigne, B.Sc.); Chlorite Bleaching of Cotton (Dr. R. S. Higginbotham, B.Sc., and R. A. Leigh, B.Sc.); Bleaching Machinery (D. E. P. Norton, B.A., A.M.I.C.E.). Abstracts from three of the papers are given on this and following pages

IN his paper to the conference Mr. D. E. P. Norton, B.A., A.M.I.C.E. (Sir James Farmer Norton & Co. Ltd.), said the major disadvantages with a rope plant were (*a*) cracking of the surface of some hard-spun fabrics, particularly when a chlorite bleach is used, (*b*) the cloth must be scutched after bleaching and this involved an extra operation and (*c*) uniform impregnation was sometimes difficult. It had also been said that washing in the open width was better than washing in the rope form, but in his opinion this had yet to be proved.

Having decided whether to bleach in the rope or open width one then decided the process and what chemicals were available and best suited to it. Here, Mr. Norton stressed that no matter which process was chosen there was sure to be a British built plant which would do the job. The process would determine the type of saturator, size of the storage chamber, the material of construction, the number of stages in the plant. For this country automatic controls were well worthwhile and could be fitted to regulate speed, tension, temperature, saturator level and concentration, nip pressures, etc. Water supply was another important factor. The saturator, went on Mr. Norton, might be the smallest part of the plant but it was also one of the most important. If the squeeze was not level, the resultant white would not be level. If saturation is not thorough the bleach would lack uniformity.

The latest type of saturator was intended to overcome the difficulty that with a single nip it was not possible to use sufficient pressure to obtain thorough saturation without reducing the carry-over too much. On this later design the fabric was heavily squeezed after passing through the first half of the liquor box. This ensured thorough saturation and complete de-aeration and penetration. After passing through the second half of the liquor box, the fabric was given a light squeeze to adjust the pick-up to the desired amount. Usually the desired pick-up was in the region of 100% and obviously only a light nip would give such a large expression. Before leaving open-width saturators, Mr. Norton said it was worth observing that on a rope plant it was advisable to saturate undesized grey in the open width if uniform results were to be obtained, due to its relative unabsorbency.

Discussing storage chambers, he described the latest type of "J"-box of Dupont construction. The earlier heated tube had been replaced by a box of large section and steam was admitted just below the plaiter. It was found that the annular heater tube of the earlier boxes suffered in course of time from the abrasion of the rope fabric and maintenance costs were fairly high. The top of the new box was curved to closely follow the contour of the draw drum so as to force the steam onto the fabric. The top was detachable for access and the bearings and the drive to the plaiter are mounted externally. In the Becoc design steam was applied to the cloth just below the top of the pile. The cloth itself acted as a seal and the box was not covered.

Most of these materials would withstand peroxide, but for a reasonable life with chlorite, stoneware, titanium or a glass fibre bonded by a suitable resin should be used. The corrosive conditions in a "J"-box differed from those in a steamer. The steam to chlorine dioxide ratio was less due to the reduced overall volume. The rate of corrosion varied with the pH, therefore the use of an accelerator permitting a high pH was sometimes an advantage.

The cost of the "J"-box did not vary much with size, so that a box with less than, say 1,000 lbs. capacity was not a worthwhile proposition. The maximum capacity in practice was about 3 tons. In a box of larger size the pressure on the cloth at the base was considerable and on one very large box it was found necessary to use an axe to remove the fabric, said Mr. Norton.

Some of the various means of storing cloth in the open width, were also described by the lecturer. First the batch system. This could be done continuously or semi-continuously. A recent semi-continuous plant discussed, comprised saturator, heater and batch chamber. After leaving the saturator the cloth went into a short steaming chamber in which it was heated up by steam jets to the desired temperature and then rolled up under constant tension on to a large batch of 5 ft. or more diameter, containing 6 to 8,000 yds. The batching apparatus was usually enclosed in a large movable container made of stainless steel, titanium or resin bonded glass fibre. When the batch was full, the container was rolled away and replaced by another. The full batch was stored for several hours depending on the process. During this period the chamber was maintained at the desired conditions of temperature and humidity by injecting wet or dry steam. The batch itself was rotated slowly by a small geared motor.

For processes requiring shorter storage periods a system of continuous batching could be employed. The Benteler and Smith auto-bleach machines were examples of this and a slide shown to the conference showed the arrangement of the auto-bleach. A double fold of fabric was wound on to the first roller. When full, it was swung to the bottom position and the outer fold wound back onto the empty top roller along with more fabric from the saturator. The inner fold on the bottom roller was led on to the next process. Whichever type was used the batch system had the advantage that it was easy to prevent the fabric creasing.

One possible alternative to the batch system was where the fabric was stored on a slowly moving conveyor. This had the advantage of simplicity and of being fully continuous, and has the ability to mix fabrics of varing widths. On early American machines the height of the cloth pile was kept to a few inches, to reduce the weight on the bottom fold, and the necessary storage capacity obtained by running several conveyors one over the other.

At this stage another slide then showed an alternative system with only one conveyor. By carefully piling the cloth on to the conveyor it was possible to considerably increase the depth of pile without causing creasing. A series of rollers at the delivery end brought the fabric folds to a more or less horizontal position so that they could then be withdrawn from the chamber without rubbing or excessive tension.

A recent development of the old slack rope washer was also described. This was a relatively slow machine with a maximum speed of 100 m/min. but had the advantage of using very little water. The wash box was sub-divided into compartments and the washing water recirculated through a spray system. The degree of contamination of the wash liquor was controlled by removing a proportion of the squeezed out liquor in a trough underneath the squeezing nip. The machine had pneumatic loading and an automatic stop motion for knots, and other devices.

Washing in the open width could be done in a conventional multi-tank machine Various devices were now on the market for improving the performance in order to reduce the size and cost of the machine and simultaneously to improve the result. Various types of sprays could be fitted, but so much foreign matter, lint and fluff left the cloth in the early stages of bleaching, that it was sometimes difficult to prevent sprays, fed by recirculated water from choking-up. This trouble, however, could be avoided by using vibrators, heaters, or pulsators to accelerate the rate of washing. In addition to vibrators, open width machines could now be fitted with hoods to increase the tank temperature and save steam or with additional rollers which provided a double run of cloth and so increased the cloth capacity of the tank. This provided a longer time in the liquor for comparatively little extra cost or space.

Textile Institute Conference

Bleaching

THE English bleacher has tamed kiering; he has tamed chemic: and he has a first class control test in fluidity which, coupled with the use of a few pH indicators, enables him to see that all is well, or to detect the source of any trouble, stated Mr. F. V. Davis, B.Sc., F.R.I.C., F.T.I. (James Hardcastle and Co., Bolton). The product is of excellent quality and the cost low. Production may not be on a continuous basis, but it approaches it closely in a mechanised croft.

The fundamentals on which the two basic types (*a*) caustic and (*b*) lime bleach have been established are:—

(1) Complete removal of impurities before chemic: "short cuts" might give a good initial white, but this might discolour or give rise to odours on storage, through formation of chloro-amines.

(2) Good wettability is only attained by almost complete removal of wax or grease, and the response to some mechanical finishes is also dependent on very low grease contents.

So long as the traditional alkali kier boil and chemic oxidation is used, these seem to be valid, but if oxidation bleaches other than hypochlorite are used, what then?

Outlining the developments in hydrogen peroxide bleaching, the speaker gave some reasons why American continuous bleaching methods had not been readily accepted in this country, where bleachers here tended to regard peroxide bleaching as for special cases rather than for general use. As his function was merely to give an introduction Mr. Davis said he did not propose to deal with the newer modifications of peroxide bleaching, or say more about the third oxidising agent, sodium chlorite, than that it had been exploited much more on the Continent than it had here.

A number of points deserved some thought. Did wettability depend on the amount of grease its chemical constitution: or its distribution? It was well known that grey cotton treated in water at 95°C. for 10 min. or so and then dried at low temperature became wettable, although the grease content was unaltered. If it was dried at high temperature, or after-ironed, it became unwettable again. This was usually explained by the formation of more or less spherical grease globules by surface tension effects in the hot water. American continuous bleaches gave grease figures about 0·4% which would be regarded as unacceptably high by English standards, yet wettability was good. The theory was that the peroxide modified the grease chemically so that its water repellency was lowered. But completely grease-free cotton produced by solvent—extracting grey was unwettable unless an aftertreatment with hot alkali or acid was given.

This had given rise to theories about pectin layers conferring unwettability; or conversely of surfaces etching of fibres conferring absorbency. Degussa had covered by patent very mild short alkaline aftertreatments to confer absorbency on cotton which was still water-repellent after pad-steam chlorite bleaching, which could mean that residual grease was chemically modified by chlorite so as to be easily removed afterwards. Yet immersion treatments or long batching treatments with acid chlorite could give absorbency without any alkaline treatment at all.

On the question of whether virtually complete removal of impurities before oxidation bleach was essential with agents other than chemic, Mr. Davis said there was plenty of evidence that it need not be. Good bleaches of good absorbency and stability were obtainable without kier boiling and without the weight-loss that went with it, both on cotton and on linen, utilising peroxide or chlorite, and in fact there was evidence in both cases that the pressure of impurities was actually helpful in the bleaching stage.

There were fabrics which could not be bleached in rope form; fabrics which were normally rope-bleached but which obviously would look and behave better if bleached in open width, and fabrics normally regarded as perfectly satisfactory bleached in the rope. But even in the latter case, the dyer and (particularly) the printer was aware of irregularities in the product and felt that scientifically the whole idea of rope processing in kiers and pits was inviting such irregularity. A continuous or semi-continuous open width bleacher giving a good stable white and good uniform wettability was therefore an undeniable attraction. The problem seemed to resolve itself into the following:—

(1) Possibility of replacing kier boiling by some other process such as solvent extraction or a pad-steam method, with emphasis on open-width handling.

(2) Possibility of using oxidising bleaches other than chemic which might attack the grease as well as avoiding the necessity for complete removal of other impurities.

(3) Problems in plant design and construction associated with these methods.

In conclusion, the effluent problem with traditional bleaching was becoming more acute and processes which avoided having to deal with large volumes of strongly alkaline kier liquors would be attractive from this viewpoint. Secondly, the shortened bleaches, particularly with chlorite, just could not cope with oily marks and rubbed-in or twisted in dirt. Only a keir boil was capable of dealing with them, if indeed anything would. The problem did not seem to exist abroad. People in Germany and Holland who chlorite bleach had either told Mr. Davis they had no oily dirt in their cloth, and offered no further comment, or said they did not use Lancashire looms, and trained their operatives not to dirty cloth. Certainly the future ofchlorite bleaching in this country was to a large extent tied up with the ability of manufacturers to produce much cleaner cloth.

Textile Institute Conference

Use of Solvents in Bleaching

A FEW years ago I.C.I. started to examine the use of non-inflammable solvents for the continuous dewaxing of textiles, primarily with a view to developing an improved continuous open width scouring and bleaching process for cotton, stated Mr. N. F. Crowder, A.M.C.T., F.R.I.C., A.T.I. (I.C.I. Ltd., Gen. Chemicals Division). It was then found that by immersion in boiling trichloroethylene for only 30 sec. it was possible to reduce the fat and wax content of cotton cloth from the grey figure of about 1·0% to approximately 0·15%.

When it was realised that only a short time of contact was required this immediately opened up the possibility of dewaxing cotton fabrics continuously without the use of any retention device. In these days of the big battalions, Mr. Crowder, said he found it most encouraging to know that it was still possible for a few simple experiments, which could have been done by anyone who had two beakers and a litre of solvent, to open up the way for a new technique. A pilot plant was developed for the continuous dewaxing of cotton fabric at open width at a speed of 8 yds./min. as a preliminary step in a continuous bleaching process. Those fabrics which required singeing first could be quenched with steam instead of water so that the cloth could enter the plant in an air dry condition, or alternatively, the cloth could be passed straight into the trichloroethylene.

The solvent system was self cleaning because the solvent from the first bath was continuously overflowing into a still and the last bath was continuously being charged with pure distilled solvent from three points.

(1) Distillate from the still.

(2) Condensed solvent from the cooling coils in the extraction chamber itself.

(3) Solvent collected in the condenser above the flash-off hot water bath.

The flow of solvent through the system was by gravity and the rate of distillation

(*continued on page* 73)

arranged so that the last compartment remained substantially free from wax when the plant was operating continuously. Water was separated from the condensate from the flash-off compartment by passing the solvent/water mixture through a gravity separator.

Dewax/Flash-off Unit

The flash-off section was the means of recovering the trichloroethylene from the cloth and also of sealing the exit end of the extraction chamber. In addition, it had the effect of (*a*) wetting the cloth thoroughly (*b*) removing part of the warp size (*c*) assisting in giving a low wax content and good absorbency.

Low solvent consumption was essential on grounds of economy and, with the present design, the solvent losses were less than 2% on the weight of cloth and the cost is approximately 28s. per ton or 0·15d. per 1 lb. of cloth treated or 0·04d./yd. of 4 oz. cloth. Uniform wax removal had been obtained during long runs on the pilot plant, and the self-cleaning action operated successfully. For example, on one run of about 12,000 yds. the wax left in was 0·14% at the start and 0·10% at the end.

Loss of Stabiliser

Commercial trichloroethylene contained various stabilisers to prevent hydrolysis and the formation of hydrochloric acid, under the influence of light and heat in the presence of metals. Investigations had shown that although there was a tendency for the stabilisers to be stripped out of the solvent in the water flash-off, these were largely recovered and in practice a satisfactory level was easily maintained, if necessary, by the addition of extra stabiliser. Recently a new grade of trichloroethylene had been introduced with which there was no loss of stabiliser during running.

Mr. Crowder then discussed the full scale dewaxing units which had been erected, and said that in the latest large scale plants they had reverted to a single flash-off tank because experience had shown that this would be adequate. An alternative method of freeing the cloth from the solvent was to pass the fabric through steam and efficient recovery of solvent was being achieved on another commercial plant operating very successfully, using this system. The solvent losses were less than 2% on the weight of cloth treated and in some circumstances such as where steam was readily available, the costs of construction and operation of the plant might be lower than when using the hot water flash-off system already described.

General experience had shown it was easier to desize, scour and bleach cloth which had been dewaxed first, whether the subsequent processing was carried out batchwise or continuously. Dewaxing also had the advantage in all cases, that the cloth was partly desized in the flash-off and, dewaxing removed adventitious oil and bitumen stains which would otherwise require spotting treatment.

(1) For example, if difficult cloths, such as poplins and haircords were dewaxed first, only one kier boil was required instead of two. The bleaching and absorbency were better and more level and the overall cost of the process slightly less.

(2) When using scour/hypochlorite/peroxide sequence, the kier boil could often be eliminated completely if the cloth was first dewaxed. The water flash-off ensured the cloth was thoroughly wet out prior to the hypochlorite treatment.

(3) Mixed fabrics such as cotton/rayon and "Terylene"/cotton which would not withstand kier boiling could be scoured and bleached more readily after dewaxing.

The solvent scouring of raw wool has many attractions, said Mr. Crowder, possibility of adapting the dewax/water flash-off technique for this purpose was being examined, because they believed it had advantages over all other solvent processes. The same technique for continuous scouring of woollen piece goods was also of interest because of the great saving which could be effected in the cost of spinning oil, and in the case of worsted piece goods it had been proved that a solvent scour followed by a short continuous aqueous scour gave better results than treatment on two continuous aqueous scouring ranges.

Mr. Crowder stressed that the continuous solvent extraction of textiles using non-inflammable trichloroethylene followed by flashing-off, was a new technique but was gradually being accepted and used commercially:— in (*a*) bleaching of cotton piece goods. (*b*) de-oiling of jute piece goods prior to plastic coating and (*c*) scouring of woollen piece goods. A machine is almost completed for the solvent scouring of worsted piece goods.

Fast Level Shades on Continuous Filament Nylon Fabrics

RECENT technical information released by British Nylon Spinners Ltd., reviews the choice of methods available for applying fast level shades on continuous filament nylon overalls. For the purpose, fast dyes are considered as belonging to the acid, metal complex, chrome and reactive classes, in which fastness properties range from good to excellent.

Some progress has been made in the application of fast dyes in level shades by normal dyeing methods, based on the selection of those acid dyes which are relatively insensitive to yarn structure variations.* Unfortunately, it is not possible to produce a complete range of shades with selected insensitive dyes because many of them are incompatible. "Nylomine"† dyes, however, are fast dyes which possess reasonably good wet and good light fastness, are compatible with one another, and give a good range of shades throughout the spectrum. They are less sensitive to yarn structure variations than are the majority of acid dyes, and are useful where good fastness is essential, and some slight stripiness can be tolerated. Their wet fastness can further be improved by subsequent back-tanning.‡

In general, dyeings with selected fast dyes have been restricted to deep shades (such as black, navy blue or nigger brown), yellow or orange shades (since the eye is less sensitive to differences in amount of colour in this region of the spectrum), or when a pronounced surface pattern of the fabric breaks up any stripiness, and for ground shades which are subsequently over-printed.

* * *

* *Tables showing the sensitivity of a wide range of dyes to deliberately introduce chemical and physical variations in nylon yarn have been published in "J. Soc. Dyers and Col." 74, 252 - 282 April 1958.*

Recent advances in applying fast dyes to nylon have been made in four main fronts: in pad dyeing: with dyebath additives; by the "Irga-Solvent"[1] process; and with reactive disperse dyes.

Pad Dyeing

Pad-dyeing methods are mainly for woven fabrics or stable warp knitted structures. They have in common the impregnation of the fabric in open-width with a thickened dye solution, emulsion or suspension, followed by passing the fabric through the nip (or nips) of a precision pad mangle. Ideally, this initial stage is a uniform impregnation of the fabric with the dye solution, and is entirely a mechanical process. The impregnated fabric is then dried, either in air or by radiant heat. (The padded fabric should not be touched whilst wet—although there are means of safely doing this—and special drying machines are available.) In succeeding processes the aim is maximum penetration of the filaments and fixation of the dye without any migration; various methods have been, and are still being, developed.

Techniques are well established for pad-dyeing cellulosic fabrics, and whilst the same basic principles apply also to nylon fabrics, specific problems arise from the relatively hydrophobic nature of continuous filament nylon fabrics. The composition of the pad liquor (which may also contain a solvent for the dyes and possibly a swelling agent for the fibre) and the temperature of padding are both important.

For all pad dyeing processes the fabric must be well woven and free from tight or

* * *

† *I.C.I. Ltd.*

‡ *The process is described in I.C.I.'s technical information pamphlet "Dyehouse" No. 191.*

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slack selvedges; creases (nip marks) will otherwise occur. The fabric should be thoroughly scoured and dried; in some sequences, nylon fabrics are also heat set before padding.

Pad Dyeing Systems for Nylon Fabrics.—Three processes are currently practised—acid shock, pad steam and pad roll—all basically similar. The scoured and dried (or set) fabric is passed in open width through a small capacity trough containing the dye liquor and is then squeezed to force the liquor into the fabric and yarn interstices and remove the excess.

Acid Shock Process.—This method was developed principally by Ciba Ltd.[2] The nylon fabric is padded with a solution of acid dyes or neutral dyeing pre-metallised dyes thickened with an agent of high solids content, such as Nafka Crystal gum. The padded material is then dried (hot air or radiant heat) at 80° - 100°C. (176° - 212°F.). It is then heat set at approximately 216°C. (421°F.) in the normal way on a stenter. Heat setting causes some fixation of the dye in the fibre and the resultant dyed fabric is free from barriness. A treatment in dilute acid at the boil (e.g. on a jigger) then completes the diffusion and fixation of the dye and improves the fastness. The goods are finally thoroughly rinsed and soaped to remove residual thickener and unfixed colour. This process is not suitable for deep shades.

Pad Steam Process.—Acid dyes and neutral dyeing pre-metallised dyes also give dyeings free from barriness when applied by the pad steam process. After padding and drying at 80° - 100°C. (176° - 212°F.) the dyes are fixed by steaming for 8 - 15 minutes in either a star ager or a Mather and Platt ager.[3] The goods are then rinsed, soaped at 40° - 50°C. (104° - 122°F.), rinsed again and dried.

This process is suitable for pale, medium and deep shades.

Pad Roll Process.—This process was originally developed by Rydboholms AB (Sweden) for bleaching large batches of cotton cloth; its use for pad dyeing was developed later.[4] The pad-roll machine (made by Svetema AB, Sweden) consists of an impregnating device (liquor trough and pad mangle), an infra-red heater, and a large chamber in which the batch (roll) of cloth can be rotated in steam at atmospheric pressure. After padding with the acid dye solution, the cloth is heated under controlled conditions. It then passes into the steam chamber and is wound in batch form; there it rotates for several hours under controlled humidity and temperature conditions. The dyed cloth is finally soaped-off to remove unfixed dye and other components of the padding liquor. Not all types of fast dyes are suitable and the process is said to be difficult with metal complex dyes. This process is also suitable for pale, medium and deep shades.

Use of Dyebath Additives

This method is suitable for woven and knitted fabrics, garments and yarn.

Dyebath additives are compounds which, when added to normal dyebaths, modify the dyeing system so as to produce more level dyeings. They may be either anionic or cationic in nature, or a mixture of both. Anionic compounds function by competing with the dye anions for the amine end groups (dye sites) in the nylon fibres, and therefore tend to equalise any rate-of-dyeing differences present in the yarn. Cationic agents form complexes with the dye anions, and dyeing then depends upon the properties of the dye complex rather than on those of the dye itself. Complexes which break down slowly promote stripe-free dyeings; dyeing effectively takes place from a very dilute dyebath.

Dyebath additives generally produce satisfactory results only with specific acid dyes. The range of fast level shades obtainable with any one additive is restricted. Investigations have shown the following to be of value: (1) "Lyogen P"[5] (anionic compound); (2) "Alkanol LN"[6] (cationic compound); and (3) for temperatures above the boil, "Tintogil RM"[7] (mixture of anionic and cationic compounds). Details of these methods, and appropriate dye selection, can be obtained from the manufacturers of the products.

The dyeings are usually done at 95°C. (203°F.). Most woven and warp knitted nylon fabrics must therefore be processed in open-width, to prevent the formation of irremovable creases. Enclosed dye jiggers and beam machines can be used for woven fabrics, and beam machines for warp knitted fabrics. Provided that they have been pressure steam set, half-hose, garments and garment blanks can be satisfactorily dyed in rotary-drum and paddle machines, and some weft knitted fabrics may be winch processed.

"Irga-Solvent" Process

This new dyeing process was announced in autumn of 1959 for the level application of selected acid dyes to continuous filament nylon. It involves an addition to the dyebath of benzyl alcohol and an anionic agent "Irgasol NJ." The process, for economic reasons, is at the moment being used mainly for woven fabrics on dye jiggers, but may well be capable of extension to yarn dyeing, beam dyeing of woven and knitted fabric, and garment dyeing.

Levelness similar to that of disperse dyes is obtained, and large quantities of 4 oz. nylon overall cloth are being satisfactorily dyed by this method.

Reactive Disperse Dyes

The first four of the "Procinyl"[8] range of reactive disperse dyes was announced in September, 1959, and a fifth more recently These dyes, applied to nylon from an acid bath at pH 4 - 4.5, act as disperse dyes and have good levelling properties. Fixation is then achieved by treatment in an alkaline bath. The resultant dyeings are only slightly less level than the best disperse dyes, and have moderate-to-good-light fastness and very good wash fastness. "Procinyl" dyes are a notable advance towards achieving fast level shades on nylon.

The advances in the technology of dyeing outlined in this report mean that the dyer of nylon fabrics can satisfy many of the demands made on him.

It would be over-optimistic to regard the problem as solved, but the situation has much improved during the last two years. It must be appreciated, however, that the dyer's task can either be simplified or made more difficult by his customers' attitude. On occasions—for instance, where certain fashion shades are required—a slight degree of stripiness may have to be tolerated to satisfy fastness demands completely; or it may be necessary for the customer to modify his shade requirements somewhat (on the dyer's advice) in the interests of both fastness and levelness. Well constructed fabrics also greatly help the dyer in achieving a satisfactory result.

It is essential that there should be close co-operation among all sections of the trade if the full benefit of these advances is to be gained.

• • •

2 "Ciba Review," No. 116, 1956.
3 "Ciba Review" No. 125, 1958.
4 J. Soc. Dyers and Col.," 71, 894, *Dec.*, 1955.
5 Sandoz Ltd.
6 Du Pont Co.
7 Rhodiaceta.
8 I.C.I. Ltd.

New Publications

ENGLISH AS KEY TO ADVANCEMENT. British Council, 65 Davies Street, W.1. Grosvenor 8011.

"English is the key to a large part of the world's store of information, and the printed word—in English—is the channel by which it is conveyed." says the British Council's report for 1959-60, describing how it promotes overseas knowledge and use of British books and periodicals. There is a hunger in many countries for the printed word; it spells advancement—individual, social, cultural, economic, adds the report. As a result of the Government's decision to encourage further the flow of British books and periodicals overseas the Council has undertaken a large expansion of its libraries and the services based on them. It was in 1959-60 maintaining 100 libraries regularly supplying books to some sixty more and setting up twenty-two others. To all these over 200,000 books were sent and 100,000 more were presented to local libraries. Total stocks in libraries directly controlled ran to nearly one million volumes.

THE HUMAN IMPLICATIONS OF WORK STUDY. The case of Pakitt Ltd. S. Dalziel and L. Klein. Human Sciences Unit, D.S.I.R. Waren Spring Laboratory, Gunnels Wood Road, Stevenage, Herts, (free on request).

Observation of the effects of work study on human relationships and day-to-day organisation is reported in this case study. It deals with the impact of work study at all levels in an industrial organisation and describes what happened during, and after, the introduction of work study by consultants into a medium-sized Midlands firm. It is a study of change and people's reaction to it. While making it clear that it is impossible to draw up a series of "do's" and "don'ts" for the introduction of work study, the report contains a number of useful recommendations valuable both to industry and for teaching purposes in management courses.

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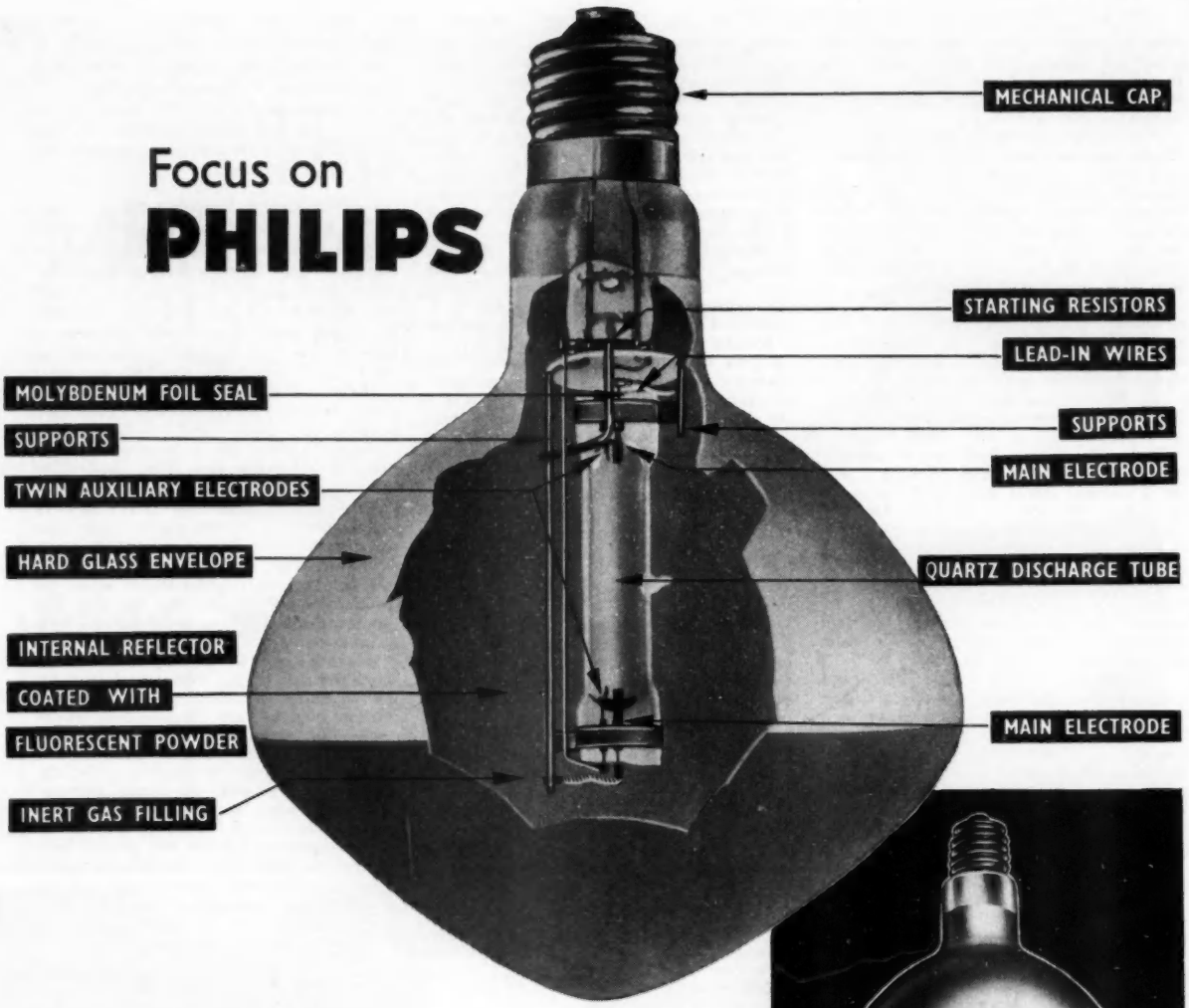

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Textile Trade and Prospects

Cotton Yarn and Cloth

Trading conditions in the last few weeks have been rather mixed, affected no doubt, by seasonal circumstances and other inescapable factors. The volume of inquiry for yarns and cloths had not been as large as in the last six months, due to lengthening order books exerting their own braking influence. The amount of shift working had also helped materially to ease an uncomfortable situation and it would certainly contribute much more to satisfying the demand if sufficient labour could be induced to work on shifts. The introduction of a shorter working week without any reduction in earnings can only be ultimately reflected in high costs for yarns and cloths. This, in itself, is enough to deter traders committing themselves too far ahead. Not only that but it offers overseas competitors still more favourable prospects to undercut U.K. manufacturers in the home market whilst reducing still further any chances they might still have in the export fields. The general international situation has similarly been anything but conducive to healthy trading. The situation in both Belgium and Laos has aroused considerable anxiety and developments elsewhere are also being carefully watched. Few are inclined to indulge in the slightest risks in such a depressing atmosphere.

In the unsettling conditions, the relative stability of raw materials and yarn and cloth margins has done much to maintain confidence in home trade circles. Some fair weights of standard weaving qualities in medium counts were booked during January for the best delivery possible. Few yarns can be had quickly, except one or two "in stock" specialities. Whilst most of the sales have been in ring yarns a considerable degree of support has been accorded to mule spun combed Egyptian-type doubling wefts and the popular types of hosiery yarns. The off-take of blended yarns—cotton/rayon, cotton/nylon, etc., remains very good indeed; in fact, certain manufacturers will now order no other types. Some in the trade still insist that certain of the difficulties arising through the scrapping programme could have been avoided with a bit more foresight and less haste. The whole of the present output in coarse and condenser type yarns is absorbed as fast as it is spun.

News of the big take-over bid for the Royal Exchange has aroused much comment amongst traders concerning the future of the facilities they have been accustomed to through the years. In cloths, an infinite variety of apparel types have been booked in cotton, spun rayon and blended examples. At present, design, finish and delivery are probably more important than price. A substantial proportion of the business booked has been replacement of depleted stocks following Christmas retail sales. With both dress and furnishing fabrics the interest has been fairly evenly divided between new design approaches in jacquard and dobby woven cloths, and in traditional and contemporary screen and roller printed specialities. Interest in household textiles has diminished slightly although one or two lines remain in urgent request. Similarly, the market in industrial textiles has eased temporarily although there is still some good business to be given out if only more settled conditions would prevail.

Wool Outlook

Commenting on the 1960-61 Australian wool sales, which resumed recently, J. S. Gale, president of the National Council of Wool Selling Brokers, said: "The wool outlook for 1961 appears sound, the woolgrowers and the people of Australia must realise that wool has to be sold to the world and that to do this greater use of the results achieved by research and more intensive promotion is necessary. It is possible that some improvements in wool prices will be realised in 1961, but it is thought that prospects must be based on a relatively modest price, if wool is to compete with synthetic fibres." Value of wool sold at auction during 1959-60 was £287,520,000 sterling for nearly 5,000,000 bales. This season's total is expected to be about 250,000 bales less. Australian wool shipped overseas during the first five months of this financial year was worth £17,600,000 less than exports for the same period of 1959-60. Preliminary figures published in Canberra give the July to November wool exports value at £94,400,000 as compared with £112,000,000 in the same period of 1959. Wool shipped overseas also fell, from 567,000,000 lb. to 538,000,000 lb. Japan was the biggest customer for Australian wool from July to November last. Exports to Japan were worth more than £28,000,000 compared with £18,400,000 to the U.K., Australia's second best customer.

U.K. wool consumption rose 5% during November, according to latest figures of the Wool Industry Bureau of Statistics. Between January and October the rate of consumption had fallen by a little more than 12%. In topmaking alone, the increase during November was 8% on the previous month but this was partly offset in the industry's total by a continued slight fall in the woollen section. Worsted yarn deliveries—believed to be heading for a 1960 output record—were a little higher in November than October, though wool fabric deliveries were about 1% lower. U.K. wool textile production figures for November were: Wool consumption, 43·07 million lb. (clean weight); top production, 28·02 million lb.; tops drawn, 20·40 million lb.; worsted yarns delivered, 23.39 million lb.; woven fabrics delivered, 34·08 million sq. yds.; blankets delivered, 3·12 million sq. yds.

From January 30 the normal working week in the U.K. wool textile industry was reduced from 45 to 42½ hours, without loss of pay; the decision thus being equal to a wages increase of between 5 and 6%. About 150,000 workers benefit by the agreement, which was reached after negotiations between representatives of the employers' federations and trades unions concerned. Appropriate time and piece rate schedules enable operatives to earn as much in 42½ hours as they previously earned in 45 hours, and a special wages structure study has been made to bring scheduled time rates more closely into accord with actual earnings. The new agreement will last until June 1962, though a revision may be sought after February 1962 if the retail price index rises above a specified level.

Mr. M. F. Schmitt has resigned as president of The Wool Bureau, Inc., a position he has held since 1954. Management, operations and programme of the Wool Bureau will now be the joint responsibility of Dr. Gerald Laxer, director of science and technology, and Felix J. Colangelo, Secretary-Treasurer.

Linen Trade Review

The changing pattern of the N. Ireland linen industry is shown from statistics relating to imports and exports during 1960. These indicate that the definite upturn in demand which was evidenced during the latter end of 1959 and throughout 1960 emanated from the home market. Exports of manufactured and semi-manufactured goods showed a decline of approximately 5% over the eleven months to November, to which the figures relate.

A nominal increase of approximately 400 tons is recorded in flax and tow imports during 1960, but at 10,199 tons the amount of man-made fibres used shows an advance of approximately 11% on the previous year. Linen yarn imports totalling 796 tons are approximately 65% above those for the corresponding period in 1959, while cotton yarn imports at 7,098 tons are 50% higher. The increase in linen yarn imports causes concern in view of the considerable expenditure on re-equipment by the spinning section. This stems undoubtedly from the fact that the competitive position of French and Belgium spinners is strengthened by their proximity to raw material markets.

Export statistics record a decline over the whole range of manufactures. Shipments of linen yarn fell by 16%, thread by 5% and linen by 4%. The most notable drop is in linen yarns and this again points to the declining competitive position of the spinning section, which must inevitably also influence that of manufactured goods—thread and linen—because of higher yarn costs.

The problem of making these competitive with Continental spins has no easy solution, but as it is the root source of the industry's difficulties in the export field, one must be found if further substantial contraction is to be avoided. As Continental mills have made comparable advance in re-equipment expenditure on

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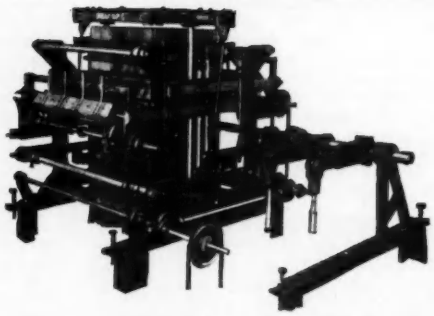

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this by British mills has failed to bridge the difference in production costs consequent on proximity to raw material markets and other advantages. These must obviously be countered by improving production techniques to permit short cut processing, a field in which Continental flax spinners have already established a lead.

Disappointment has been expressed at the N. Ireland Government decision not to provide a subsidy for flax growing in 1961, as in 1960. This is based on the failure of the offer last year: to the low quality of any fibre produced; and to the fact that, while the Government paid out over £1¼ million in flax subsidies during the decade to 1958, the acreage grown during the period declined to a nominal figure. The difference of 15s. per stone between the world price value of around 20s. and the guaranteed price of the fibre grown was bridged by a Government subsidy of about 13s. and a spinners' payment of 2s.

News of the decision to close the mills of J. and T. M. Greeves Ltd., Belfast, was received with regret throughout the trade. The company, which was acquired by the Herdman spinning group in 1960, dates back to the middle of the nineteenth century. In addition to a world wide reputation for yarns it produced some famous textile engineers and pioneered their inventions Yarn production by the group is to be concentrated at their other plants at Belfast and Sion Mills.

Expanding imports of man-made fibres and of cotton yarn point to increasing diversification in manufacture. This has been adopted most successfully by the weaving section in which redundancy is consequently less evident. The 11% increase in consumption of man-made fibres is evidence of more strenuous efforts to combat redundancy in the spinning section, and the progress achieved by individual mills has indicated the scope for development. Assured supplies of raw material, combined with price stability, provide a contrast to the uncertainties of the raw flax market.

Irrespective of the raw material used, the problems of the industry to-day relate to price and appeal, and the approach to their solution must be from the viewpoint of the consumer rather than from pre-conceived ideas on the part of the producer which has too frequently been the case in the past.

Jute Fibre, Yarn and Fabrics

The slightly easier trend in the raw jute market at the end of 1960 has now disappeared and prices are higher. Imports of loose jute from up-country in East Pakistan have not improved and the lower rates during December arose solely through poor demand from consuming countries. Buyers could not remain out of the market indefinitely, however, and with increasing Continental interest prices became firmer. This brought other buyers into the market and prices advanced considerably. At the end of December, E.P.C. values of all grades of the fibre were raised twice by £3 per ton within two days. Cultivators are regulating the flow of fibre to the local markets in Pakistan and at the same time mills there are buying steadily and this is preventing any stocks accumulating. There appears to be little prospect of prices of raw jute returning to a more realistic level before fibre from the next crop becomes available to spinners. For some time holders of secured parcels were willing to discount the market and were making offers at well under the official levels. This brought out a little interest but when larger quantities were being taken up, these cheaper sellers quickly disappeared. By the beginning of 1961, most shippers became very reserved and offers of the fibre were not being freely made. It is known that most countries have still substantial quantities of jute to buy from the present crop and as cultivators have already received very high prices for sales made, this has put them in a very strong financial position.

Pakistan authorities say they are endeavouring to increase the acreage under jute cultivation next season to 1·8 million acres. This season the area was 1·38 million and this increase in sowings will be welcome to all spinners and should eventually bring prices to a more realistic level.

At the beginning of January, the position in Pakistan became still firmer and a further rise in E.P.C. values of £3 to £5 per ton took place. There is nothing to indicate that the top of the market has been reached and if demand should continue to be in excess of supply a new "high" may be touched before the end of the present season.

Offers of the fibre are not now being nearly so freely made and some shippers are remaining out of the market until the position becomes less obscure. Mill Firsts range from £204, Mill Lightnings from £195, Mill Hearts from £192 and grade Hearts from £183, c.i.f. U.K., for January/February shipment. Grade Tossa-2/3 was at £196, grade Tossa-4 at £192 and Continental Tossa-2/3 at £191, January/February.

Spinners in Dundee have been showing interest at the higher levels and business has taken place in the fibre. Continental spinners have also been buying and this is all tending to force prices still higher.

The Calcutta goods market became much dearer towards the end of December. This was brought about by buying by some Eastern countries which was followed by an announcement that the Indian Jute Mills Association had recommended that their members should reduce working time from 45 to 42½ hours per week as from January 30. This was to conserve raw material stocks and prevent demand being such, that prices would continue to rise.

A fairly steady business has taken place in the U.K. with prices at 89/3 for 10 oz. 40 in., and at 67/6 for 7½ oz. per 100 yards f.o.b. Calcutta for January shipment, at 89/6 and 67/- February and March. "B" twills were at 280/6, 277/6 and 275/9 for the respective shipment periods.

Demand for yarns and cloth in Dundee became considerably less during the last two months of the year. Contracts already placed were not taken up as quickly as expected and because of the high prices, consumers were reducing stocks. However, towards the end of the year when raw material prices again began to advance, there was much more interest shown in both yarns and cloth. Buyers realised that there was no prospect of lower prices in the near future and on the other hand there was a strong possibility that further advances would take place.

During this period of quietness, some short time working was brought into force in Dundee and prices of yarns and cloth were kept as low as possible. This did help to bring out business and at the start of the new year the outlook was brighter but producers could not see very far ahead.

Silk and Man-Made Fibres

Although trade is relatively quiet at the moment forward bookings in yarn and cloth are particularly encouraging. Most classes of yarn are available although it is reported there has been some delay in delivery of "Terylene"/cotton blends. Some concern is expressed, however, at the reduction of advance orders compared with last year, and equally upsetting is the increasing import of made-up garments, not only from Hong Kong but from Europe, all of which directly reduce the overall demand on spinners and weavers in this country. There are few converters who are not buying some overseas' fabrics these days, in order to meet home trade demand and re-export, although this is tending to diminish. In home trade circles the use of coloured acrylic fibre is likely to expand considerably. Plenty of interest is being shown in Lancashire and colourspun Acrilan is said to lend itself ideally to the knitwear trade and present production of this yarn is being readily absorbed. In the Yorkshire sections present interest covers a wide variety of products, ranging from linings, to printed dress styles in blends of wool with other fibres, and in spun nylon for the hosiery trade.

Throwsters report a demand spread well over most fibres, with silk maintaining its position remarkably well, and nylon, "Terylene" and the bulked fibres in good request. Macclesfield reports fair activity, with screen printers more hopeful of the future than for some time, especially for silk and acetate styles. From Leek there are reports of better business and knitters in the Leek area are well employed. The Spring shows indicate a fair up-take but overall it is thought to be a little below that of a year ago.

Sewing thread manufacturers report the usual steady demand for most types of counts and folds in the widest possible range of shades. The labour problem continues to loom large in any long-term discussions regarding expansion and output not only in Leek and Macclesfield, but in surrounding districts. From the Midlands the demand extends well into the months ahead. "Orlon" and "Acril" and "Courtelle" are all in demand by knitters as well as nylon and "Terylene." Well-designed sweaters and cardigans produced in this country are regaining some of the ground lost to Italian knitwear.

CABMA REGISTER OF BRITISH INDUSTRIAL PRODUCTS FOR CANADA, 1960-61. Iliffe & Sons Ltd., Dorset House, Stamford Street, London, S.E.1 (price 15s.).

Previous editions of the register have afforded most efficient service to Canadian buyers and the new issue, with its 636 pages, gives most effective coverage of British products. More than 3,000 products and their suppliers are listed in the classified list of products which is followed by an excellent glossary of French equivalents. A directory of roughly 4,000 British firms indicates also their distribution arrangements in Canada and is accompanied by lists of proprietary names and trade marks. Rapid identification of sections is achieved by the provision of a slotted index and the use of tinted paper.

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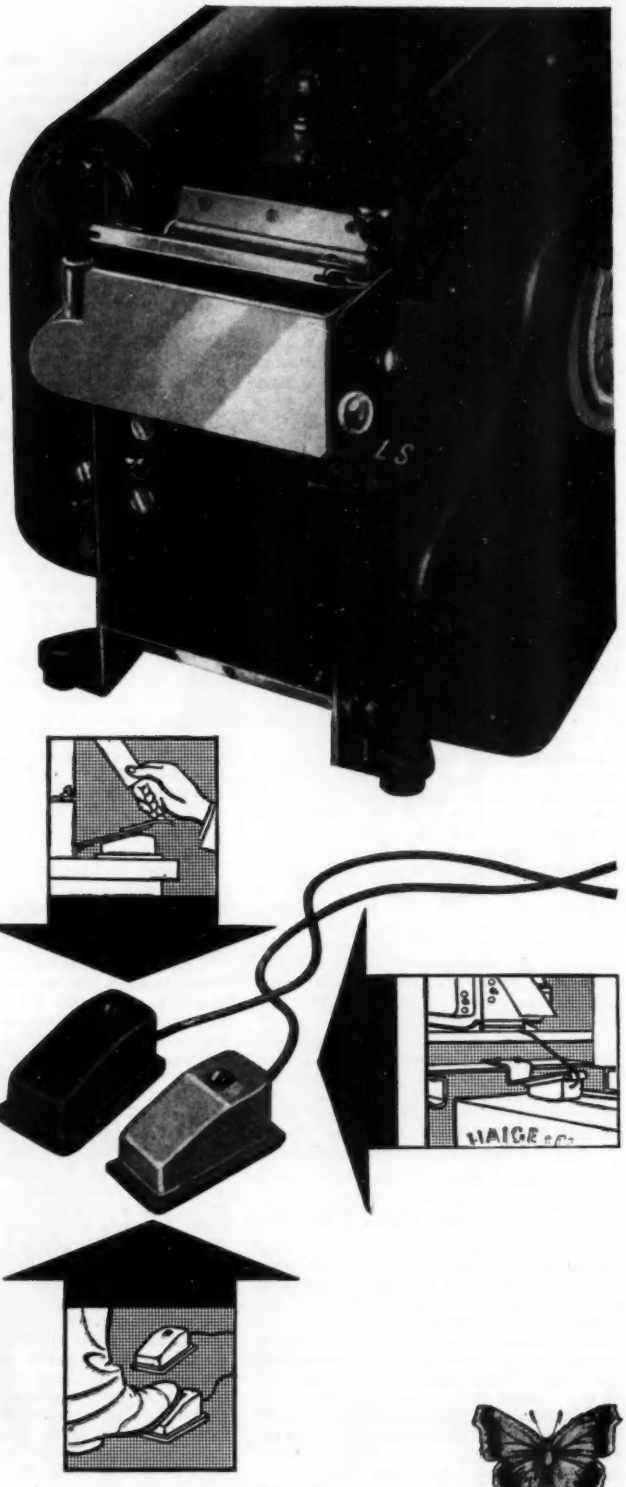

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Notes and News

Modern Diecasting and Textile Equipment

Converted from one of the mills recently closed under the cotton industry re-organisation scheme the thoroughly re-designed and equipped modern factory now occupied by Thomas Ashworth and Co. Ltd., Sycamore Avenue, Burnley, Lancs., produces pressure and gravity diecastings in zinc and aluminium for over 200 manufacturers. Ranging in weight from fractions of an ounce to 50 lb., 14,000 of these castings are despatched every day, many to export markets, e.g. 260,000 castings were sent to the U.S.A. last year.

In addition, of course, the company manufacture and market their own specialities including the "Speedy" moisture tester and the "Taco" weavers' and warpers' beams and cloth rollers in light alloys which are 30 - 50% lighter than old-style equipment. Cast and precision machined to very fine limits these specialities are designed for truer running and greater accuracy in warping and weaving.

The "Taco" high tensile weavers' beam is made for all types of cotton, wool, rayon, linen and jute looms in flange sizes ranging from 11 to 26 in. dia. with a choice of several barrel sizes and ruffles. The MK.II is also a precision made job specially designed to meet the requirements of manufacturers weaving the modern fibres. Made from 6 in. o.d. barrel high tensile aluminium, there is a choice of flanges ranging from 16½ to 24 in.; no paper collars are needed. Amongst other features, these have a novel screw adjustment in the shape of a three-start thread, the form of which prevents yarns rolling into the screw thread when starting a new warp. This innovation also allows quicker flange adjustment when required; one complete revolution of the flange gives 1½ in. of movement along the barrel. "Taco" warpers' beams are made in two types, a standard model for warping speeds up to 400 yds./min., and a high speed type for speeds up to 800 yds./min.

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New Silicone Emulsion

Following extensive trade trials the experimental silicone product E.P. 277—developed by I.C.I. Nobel Division as an efficient water repellent agent applied by a new exhaustion technique—has now been added to the established sales range as M.477.

In the exhaustion technique—which can be applied by dolly, winch or washer—two catalysts are employed. When textiles are made water repellent by the exhaustion method no elaborate special equipment is needed. The necessity for a high temperature bake is eliminated, because the silicone cures in the range 100° to 120°C.

This emulsion is claimed to give effective water repellency to wool yarns before knitting into garments, while results on hose and outerwear knitted from treated wool yarns are encouraging. M.477 is also suitable for the water repellent treatment of wool mixtures and of pure synthetic fabrics.

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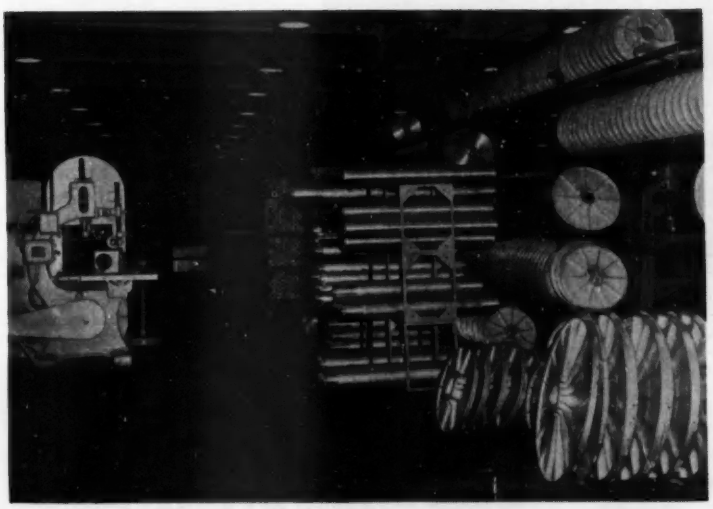
N.I.F.E.S. Courses on Oil-Firing

Three-day Courses on Fuel Oil-Firing are to be held at N.I.F.E.S. Office, Ailsa House, Kings Road, Reading, during January, March, May, June, September, November and December 1961. The courses are designed to meet the needs of industrial plant engineers, heating engineers and staff responsible for oil-fired boiler plant. Application forms may be obtained from the National Industrial Fuel Efficiency Service, 71 Grosvenor Street, London, W.1.



Some of the wide range of warpers' and weavers' beams and flanges in the new factory of Thomas Ashworth and Co. Ltd., Burnley

Marking Machine Sales and Service

Markem (U.K.) Ltd., announce the opening of a sales and service office at 24 Brownfields, Welwyn Garden City, Herts, offering technical assistance plus the integrated line of powered marking machines, type, and specialty inks made by Markem Machine Co., Keene, New Hampshire, U.S.A., to mark, label, and identify products and packages. Facilities for stocking supplies and accessories as well as a demonstration showroom are included in the new office.

• • •

A.K.U. Linen Yarns

Algemene Kunstzijde Unie N. V., Arnhem has decided to start production of linen yarns by a new process which, it is stated, will result in a considerable reduction of the processing from flax to linen, greater strength and better treatment of the yarn. The process was invented by the Fibre Research Institute T.N.O., Delft, and developed in close co-operation with Novivlas N. V. The latter corporation was established in 1954 on the initiative of various parties interested in flax-growing and the flax and linen industry.

• • •

South African Wool Offerings

Continued severe drought in South Africa reduced the total offerings of wool in the July-November period—445,000 bales—by 8% in comparison with the 1959 figure. Selections of wools remained average to good to all ports although clips from the north-western Cape Province showed the effects of the drought. Total weight of wool sold was 118 million lb. which realised £18½-million at an average price of 37·8d. a lb. Comparative figures in 1959 were 129 million lb., yielding £23 million at 43d. a lb.

Because of the better tone in the market the South African Wool Commission in November bought only about one-third of its purchases in each of the two preceding months. The quantity of 8,386 bales—5½% of the offerings—compared with 25,175 bales—17%—in October. France still headed the list of buyers of South African wool at the end of November with purchases of greasy and scoured wool totalling 18½ million lb., although the U.K.—traditionally the main buyer—was closing the gap with purchases of 15·7 million lb. Third was Germany with 12 million lb. Russia had still not appeared on the market.

• • •

Hours of U.K. Wool Textile Workers

Shorter working week (from 45 to 42½ hours) in the British wool textile industry, without loss of pay, has been offered by employers through the industry's negotiating machinery. The offer, made at a joint meeting in Bradford of representatives of employers' organisations and trade unions in the industry, is equivalent to a wages increase of nearly 6%. It will be considered by the trade unions. About 150,000 British wool textile workers are affected by the offer.

Teleflex conveyor installed in the Dutch textile factory of Hollands-Zwitserche Borduurfabriek Egger N.V. Almelo. The old method of transporting loads by trolley is also shown.

Conveyorisation
by Teleflex

- **Conveyor installations in Britain and abroad have proved the enormous success of Teleflex mechanical handling.**
- **Expansion and reorganisation of Britain's textile industry will focus attention on the enormous handling problems involved in the production of fabrics which are quality famous throughout the world.**
- **Teleflex are experts when it comes to handling. Industries making goods as various as cigarettes, beer, washing machines, biscuits, car components and a host of other products have based manufacturing schemes on Teleflex layouts.**
- **If you are extending your output or reorganising your plant, consult Teleflex.**

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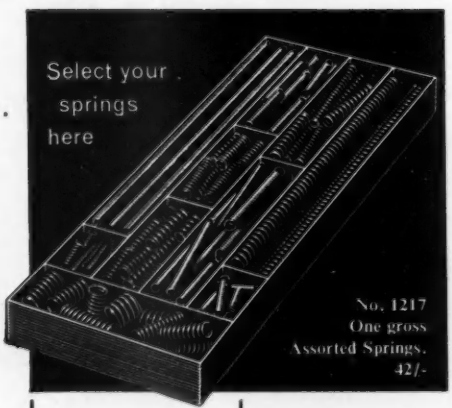
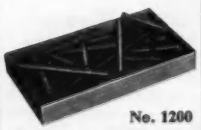
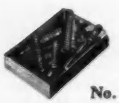
EXPERIMENTAL SPRINGS?



That spring you want . . . in a hurry . . . where is it? Pick what you want when you want it from TERRY'S BOXES OF ASSORTED SPRINGS—our fine range of small boxed assortments of experimental springs. We can show you only a few from the range here. Send a postcard for our full list—and if ever you're stuck with a spring problem send it along to our Research Department—they'll gladly help you out.



No. 1200
Three dozen Assorted Light Expansion Springs, suitable for carburettor control etc. 13/6.



No. 760
Three dozen Assorted Light Compression Springs. 1" to 4" long, 22 to 18 S.W.G., ¼" to ⅝" diam. 6/6

No. 98A
Three dozen Assorted 1" to 4" long, ¼" to ⅝" diam., 19G to 15G. 5/6

No. 753
Three dozen Assorted Light Expansion ¼" to ½" diam., 2" to 6" long, 22 to 18 S.W.G. 10/6

Cut Production Costs with Terry's Wire Circlips. We can supply immediately from stock—from ¼" to ⅝"

Looking for good Hose Clips? Send for a sample of Terry's Security Worm Drive Hose Clip and price list.

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If so, the help of our Design Staff is yours for the asking.

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HT 31D

U.S. Hopes to Produce More Wool Cloth

U.S. Dept. of Commerce forecasts that American production of wool cloth, after declining during 1960 as compared with 1959, is likely to increase in 1961. The decline during 1960 was expected to be about 5% but the Department anticipates a moderate increase in 1961 — perhaps early in the second quarter of the year. The forecast is based on the fact that American spending on consumer goods remains steady and that healthy purchases of clothing are expected this year. The National Wool Textile Export Corporation in Bradford has issued a table of landed costs of British wool fabrics in the U.S. under the new American tariff. It shows that a 12 oz. a yard cloth with a British selling price of 7s. a yard, will have a duty-paid value on entering the U.S. of 14s. 1d. A similar weight cloth costing £1 a yard will have a landed cost of 30s. 8d.; and at 30s. a yard U.K. price, its landed cost in the U.S. will be 44s. 5d.

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T.I. Representatives

Mr. A. Draper, F.T.I., (vice-chairman of Council, Textile Institute) has been appointed its representative for the forthcoming year on the Empire Cotton Growing Association. Mr. A. W. Bayes, B.Sc., F.T.I., (member of Council and director of Ashton Bros. Ltd.) has been appointed representative on the Standard Policy Committee for the Cotton Section of the Textile Industry.

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Synthetic Latex Plant

To meet growing demand for synthetic latices by the textile, etc., industries, and for adhesives by industry generally, Dunlop Chemical Products Division has taken over control, for production and sales, of the Dunlop synthetic latex plant at Erdington, Birmingham. The plant was previously operated by the Central Research Division, although sales were the responsibility of Chemical Products Division. The change is to allow greater operational flexibility.

• • •

Young Tweed Workers Pay

More than 500 apprentices and teenage workers in the Scottish woollen industry received pay increases as from January 9. The new scales which enable youths to be paid adult male time rates at 19 instead of 21, have been agreed by the Scottish Woollen Trade Employers' Association and the three trade unions concerned. The new scales for boys and girls (old scale in parentheses) are as follows:— Age 15, 45% (36%) of the adult male time rate; age 16, 55% (44%); age 17, 65% (55%). At 18, girls will continue to receive the full adult rate for women, while boys go on to 85% of the men's rate (old scale, 66%), reaching the full time rate at 19 years of age.

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Electromagnetic Yarn Tension Control

An electromagnetic control manufactured by Fabrionics Corp. of Huntington, N.Y. is claimed to maintain constant yarn tension during warping, weaving, coning, knitting, twisting and winding. The new device, called the Una-Mag, consists of two steel discs drawn together by an electromagnet. Tension applied to the yarn is quickly and easily regulated on as many as 200 Una-Mags by a single potentiometer knob that regulates the electromagnets. This, it is pointed out, makes it possible not only to maintain constant tension on one yarn end, but to keep the same tension on all ends, so there is little chance of uneven yarn packages, dye streaks, unequal package dyeing and similar problems caused by uneven tension. The makers say extensive tests have shown that the Una-Mag can improve the performance of knitting machines by more than 12%, and can raise the output of coning machines by as much as 30%. Further information can be obtained from Fabrionics Corp., Box 521, Huntington, N.Y., U.S.A.

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Grants for Special Place Students

So that students from all parts of the British Isles shall have awards of equal value, the Textile Institute Council has decided that for future conferences, grants for the special place students will be railway fare, hotel expenses and a sum for out of pocket expenses. This takes the place of the cash grant awarded previously.

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Marketing Non-Wovens

Under a recent arrangement, Fothergill and Harvey Ltd., will sell the products manufactured by Lantor Ltd., for industrial uses. Among these uses, in the field of reinforced plastics, are high and low pressure laminates, the two main applications for non-woven fabrics in the field of high pressure laminates are for use in sheet form and for gear shapes. In the field of low pressure laminates they have wide applications as surfacing tissues for polyester/resin/glass laminates for various uses in chemical plant or for factory windows. Non-wovens can also be used for filtration purposes of air and liquids. Filters made from non-woven cotton bonded with synthetic rubber are said to give a lower back pressure than woven fabric filters

• • •

Bri-Nylon Net

Price reductions are announced by John Heathcote and Co. Ltd., Heathcote House, 20 Savile Row,, W.1., for their flare free Bri-Nylon net. Quality No. 1 retails at 2s. 11d. per yd., and Quality No. 2 at 2s. 6d. This 54 in. wide net is now produced in a range of 56 shades.

• • •

I.W.S. Summer School

The Summer school of the International Wool Secretariat will be held this year from August 21-25 at the City of Bath Technical College.

The programme will include lectures on many aspects of wool and a series of visits by coach to wool mills in the west country.

Registration fee is 15s. Accommodation details and further information from the Dept. of Education, International Wool Secretariat, 18-20 Regent Street, S.W.1.

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Wool Fashion Colours for 1961

Colours for wool knitwear and fabrics for autumn/winter 1961 will include Florence beige, ranch mink, birch bark, swift grey, two browns called Palissander and Moresco and three greens—Findhorn and Howard green, two muted olive types and Kendal green, a dark blue-green. There will be two violets—Russian violet and Wistaria—and a jewel red, which is described as a "glowing red, richer and darker than pillar box red." Colours were selected by the British Colour Council and are now being incorporated into manufacturers' ranges.

Flights to Leipzig

K.L.M. and Sabena will operate two direct flights daily from London to Leipzig during the Spring Trade Fair opening in March. The flights, from March 4-15, will be via Amsterdam (K.L.M.) and Brussels (Sabena). Other flights are available via Amsterdam/Brussels and Berlin. Frequent daily flights are available from East Berlin to Leipzig for visitors arriving by air in West Berlin. During the Fair, there will be direct flights between Leipzig and Zurich, Stockholm, Copenhagen, Belgrade, Budapest, Vienna and Prague.

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Factory Project in Bulawayo

In Bulawayo, reports Barclays Bank D.C.O. from Southern Rhodesia, an option over five acres of industrial land has been granted to Fine Wool Products of South Africa Ltd. This company proposes to erect a factory costing £46,000 to contain plant and machinery worth £115,000, provided import duties are increased on worsted goods to protect local industry.

• • •

Mather and Platt's "Dummy Run"

The sales staff of Mather and Platt Ltd., Manchester and Radcliffe are men with an important mission to Russia. The company are to exhibit at the Moscow Trade Fair in May and, in addition to the most meticulous planning for the exhibition the sales staff have been hard at work taking daily lessons in Russian to overcome the language barrier and thereby be of far greater service to visitors anxious to learn as much as they can about the company's specialities.

Determined to present British engineering to the Russians in the best possible manner, the company recently held a "dummy run" featuring their intended display for the Fair. At this dress rehearsal a wide range of machinery was shown, including rotary cloth printing machinery, dryers, unit heaters, feed pumps, packing, filling and grading machines, etc., and visitors were invited to either criticise or offer suggestions for improvements in any way.

Mather and Platt Ltd., have been trading continuously with Russia for over 100 years and Mr. W. L. Mather (chairman) said they had had discussions with officials responsible for the Soviet seven years' plan, to find out what they expected to be buying during the next two to three years. They had also had discussions with various branches of the Ministry of Foreign Trade in Moscow to ascertain their interests, also with state technical committees and factory managers. From these discussions they had been able to plan their stand, making certain that the machinery they exhibited would be of the latest technical specification and acceptable both for design and price.

Calling for more Government assistance to firms exhibiting at overseas trade fairs, Mr. Mathers said that firms which did not exhibit indirectly benefit from the efforts of the others who did. "Practically every other nation provides help and I feel that we British exporters are at present at a disadvantage in comparison with our foreign competitors."

Regarding the cost of these efforts it is interesting to note that it will absorb in the region of £30,000 to stage this show.

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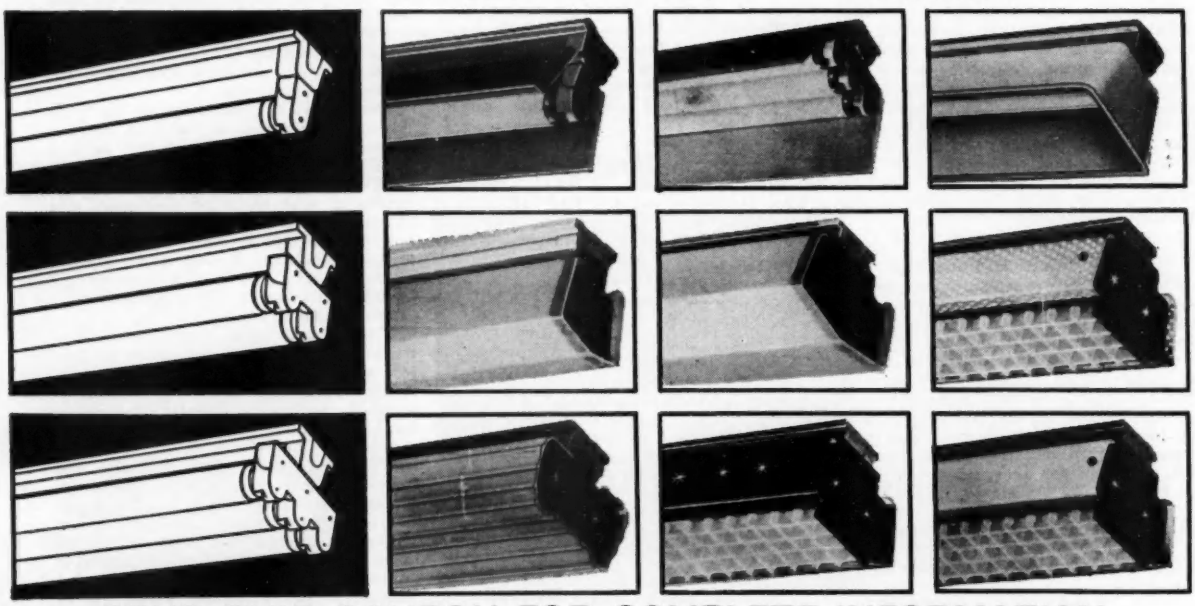
The newest, slimmest lighting fittings for 1, 2 and 3 lamps 5ft. 80w (1 & 2 lamps 2ft. 20w, 4ft. 40w)—with a big range of reflector and diffuser attachments

Philips Streamlite – it's the newest thing in fluorescent lighting fittings. And it outdates every other type of fitting on the market. For Philips Streamlite – so slim, so sleek, so stylish – has far more to offer than any other fluorescent fittings you can buy, including some advantages that are as unique as they are striking:

- *Philips Streamlite gives you Switch and Switchless start in the popular sizes.*
- *There is a choice of one, two or three lamp fittings – all equipped with Philips even slimmer Polyster ballasts.*
- *B.S. Box fixing and conduit entries at 24" centres.* (*B.S. 2467*) 2ft. 20w. 17½" centres.
- *It is extraordinarily reasonable in price.*
- *It is suitable for single* and *continuous mounting.*
- *Philips Sprung Rotor lampholders with earth plungers for lamp end-caps—rapid fixing, automatic positioning.*
- *10 amp. mains terminal block, and earth connection.*
- *Full length back plate with rigidly secured cast alloy ends providing earth continuity for end entry conduit.*



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To: Philips Electrical Ltd., Lamp and Lighting Group, Century House, Shaftesbury Avenue, London, W.C.2

Please send me the comprehensive leaflet giving full details of Philips 'Streamlite' fittings.

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RECENT TEXTILE PATENTS

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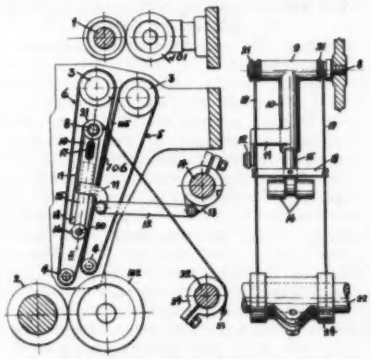
828,638 Flax, Hemp, etc., Drafting Units

A. GARDELLA AND C. GARDELLA, 11 *Piazza della Vittoria, Genoa, Italy.*

A double endless belt sliver drafting unit for a spinning frame, particularly for drafting long and hard fibres such as hemp, flax, jute, sisal, etc. 1 and 101 are the feed rollers and 2, 102 the delivery rollers of a drafting device. Between the rollers run two endless belts 5, 6 which are mounted on two pairs of rollers 3, 4 and have two contacting runs 105, 106 which are driven in the same direction. The sliver is guided between the endless belts and is wholly supported during drafting. A pivot 8 is journalled in the machine frame between roller 3 and roller 4 of one of the belts, and this pivot is fastened with its axis parallel to the axes of rotation of the rollers. A hub 9, having a telescopic device 10 at right angles is mounted on the pivot so as to swing freely. The device 10 extends between the two runs of belt 6 and its lower end has a bracket 11 which projects and extends beyond the edges of the belts 5, 6. The free end of the bracket outside the belts is curved out of the planes of the belts and is connected by means of a link 12 to a crank 13 fastened on a shaft

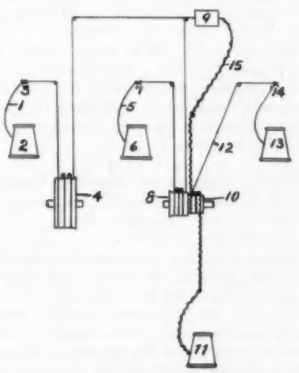


14. The angular position of the shaft, or of the crank with respect to the shaft, may be adjusted by hand by conventional means (not shown), thus varying the angular position of the device 10 with respect to the plane of the belt run 106. A rod 15 is slidable in the tubular arm of device 10 and this rod, which is urged outward by a spring 17, carries at its end a pair of rollers 16 mounted on a pivot 20. By suitably adjusting the angular position of device 10, the rollers 16 are urged with greater or less pressure against the run 106 of the belt 6. The rod 15 is held against the force of the spring by a variable tension device in the form of two flexible cords 19 attached to a member 18 secured to the lower end of rod 15. The cords pass over two small grooved pulleys 21 mounted on both sides of the hub and are fastened at 23 to a split sleeve 24 fastened on to a small shaft 22. The cords are drawn a required distance by appropriate rotation of shaft 22 thus varying the amount of projection of the rod 15 from the arm 10 and consequently varying the position of the rollers 16 on the belt run 106.

828,641 Fancy Yarns

COURTAULDS LTD., *London*

Production of bulky fancy yarns, having the general appearance of a boucle yarn. The process for the production of such mock-boucle yarns comprises feeding as least two bundles of continuous filamentt into a zone of turbulent gaseous fluid, at least one of the bundles being fed at a greater linear rate than another of the bundles, withdrawing all the bundles from the zone as a single assembly and imparting twist to the latter. Bundles of continuous filaments 1, 5 on bobbins 2, 6 are passed by way of tension devices 3, 7 on to



individual input godets 4, 8 around which the bundles are wound at least three times. The godets are of different sizes and may also be driven at different speeds to ensure overfeeding of bundle 1 relative to bundle 5. From the godets the bundles are combined just before they enter the bulking jet 9 in which a turbulent zone is produced by a high velocity air jet. From the device 9 the bundles emerge as a single bundle 15 of convoluted filaments which is carried at least three times round the output godet 10 mounted on a common driving shaft with the godet 8. The godet 10 is smaller in diameter than the input godet so that the difference in peripheral speeds allows a length-wise contraction of the filaments between the godets. Finally the bundle is twisted and collected by a cap or ring spinning device 11. A scaffolding thread 12 from supply bobbin 13 and via a tension device 14 may be run in with the convoluted bundle on the godet 10 and the combined yarn and scaffolding thread collected by the spinning device.

828,686 De-woolling Sheepskins

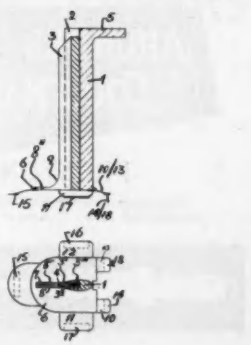
H. BOOTH, 165 *Radley Road, Abingdon.*

A composition for the de-woolling of sheepskins or the de-hairing of skins comprises a lime-free, water-soluble sulphide as an accelerator for the alkali, an inhibitor for the oxidation of the sulphide and a promoter for the oxidation of the sulphide. The inhibitor is such that it will diffuse with the sulphide through the skin and thus be active at the hair root and the promoter is incapable of diffusion through the skin and therefore is active only on the surface A suitable inhibitor is sodium sulphite and a suitable promoter is active iron, which may be in the form of ferric oxide. China clay contains an appreciable quantity of iron compounds and therefore serves a dual purpose as thickener and promoter. A suitable alkali is caustic soda.

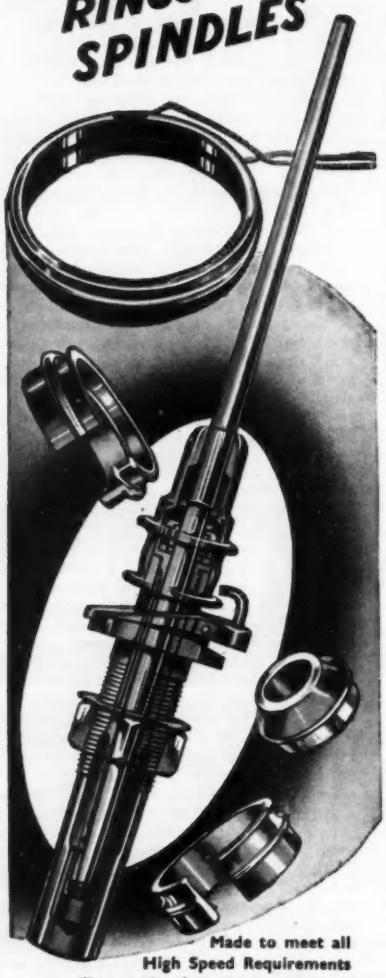
828,874 Vertical Cloth Cutting Machines

M. HOOGLAND, 549 *Koelner-Land-Strasse, Bonn, Western Germany.*

Relates to improvements in vertical cloth cutting machines. The knife (not shown) is mounted to reciprocate in a slot 2 milled in a guide pillar 1 formed with a flange 5, the slot 2 being lined on each side of the blade by a lining 3^{1}, 3^{11} to provide a pocket 3 for the knife. The lining is formed of sheet metal on each side of the slot and separated by a distance piece 3^{111} the thickness of which is equal to that of the knife. The knife reciprocates in the slot 4 between the lining plates. A base plate 6 is formed with a slot 7, into which the knife penetrates when at its lowest position. The lining 3^{1}, 3^{11} extends through the base plate to the lower edge of the slot 7. The lining is extended forward in the slot at 8^{1}, 8^{11} to totally enclose the point of the knife when in the base plate, and the sides of the pocket 3 are radiused at 9 where they join the base plate 6 to form a guide for the knife. The linings of pocket 3 are curved inwards to form convex curves and provide a continuous and spring support and guide for the point of the knife when at its lowest position. The base plate may



Arunco
RINGS AND
SPINDLES



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be provided with extension plates 10, 11, 12 and 13 of light gauge metal having an elongated S shape to raise the plate from the cutting out table. Rubber pads 14, 15, 16, 17 and 18 may be provided on the underside of the plates to increase their friction on the table. The pads offer greater resistance to transverse movement of the machine than in the cutting direction thereby facilitating the guiding of the machine. A knife mounted as above facilitates the cutting of curves in material and renders the knife more rigid in operation, so that soft materials such as frottee, charmeuse and soft silks may be cut and a greater precision in the cutting of the lower layers is obtained.

829,075 "Union Dyeable" Fibre Blends

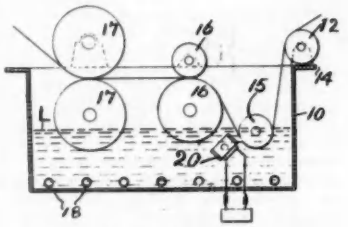
DOW CHEMICAL CO., *Midland, Michigan, U.S.A.*

The term "union-dyeable" indicates a material that is dyeable to a relatively, if not completely, uniform depth of shade in all its components so as to meet the requirements of commercial acceptability in such particulars. A union-dyeable material comprises a mixture of (1) cellulosic fibres consisting of cotton, viscose rayon or mixtures, and (2) synthetic fibres comprising an acrylonitrile polymer containing in the polymer molecule at least 80% by weight of combined acrylonitrile and in which there is intimately incorporated up to 20% by weight based on the weight of the synthetic fibre of an N-vinyl-3-morpholinone polymer or an N-vinyl-2-oxazolidinone polymer as a dye-receptive adjuvant. Advantageously the blend may be prepared to contain from 40% to 90% by weight of the synthetic N-vinyl-3-morpholin-one polymer-containing or N-vinyl-2-oxazolidinone polymer-containing acrylonitrile polymer fibre thoroughly intermixed with the cellulosic fibres.

829,296 Improved Wetting Treatment

H. A. POOLE AND F. W. BELLOWS, *North Street, and Goshen Road, Litchfield, Connecticut, U.S.A.*

Apparatus for increasing impregnation of yarns, fabrics, etc., by a treating liquid. A sizing tank 10 having a size liquid up to level L, is of a type generally used for warp sizing but with minor variations may be employed for treatment of various types of fibres, or fabric. Warp yarns W are fed over a roll 12 mounted on a flange 14 of the tank. The yarns are immersed in the sizing liquid by passage under

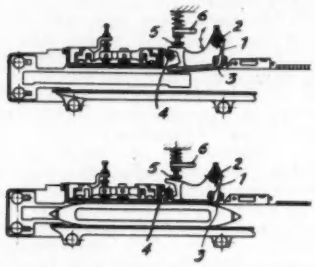


immersion roll 15 and then the warp yarns are passed through squeeze rolls 16, 16a and then between squeeze rolls 17, 17a and ultimately to a drier (not shown). The sizing liquid may be heated by steam heating coils 18 across the bottom of the tank. A transducer 20 is immersed in the sizing liquid and in close proximity to the travelling warp passing under the roll 15, thus to directly irradiate or impart vibrations to the liquid and effect deep and rapid impregnation of the liquid into the interior of the material. There will be a number of transducers disposed across the width of the tank and the spacing of the transducers may be varied as desired.

829,316 Shuttle Box Swells

METAPIC S.A., *Holding Luxembourgeoise, 144 Rue de Hollerich, Luxemburg.*

Improvements in rocking swells in looms, characterised in that the swell is hinged on a pivot disposed on a perpendicular with respect to the portion of the swell as will be first met by the shuttle when the latter enters into the



shuttle box. The swell has approximately the shape of an L, the horizontal part of which, when in the retracted position, is kept in the plane of the mirrors and the reed, the other part of the L being disposed near the portion of the swell as will be first met by the shuttle, when the latter enters into the shuttle box, the hinge of the pivoting swell being located on or near the other part of the L. The sketches show the swell in operative and non-operative positions.

829,330 Counting Filaments in Multi-Filament Yarns

BRITISH RAYON RESEARCH ASSOCIATION, *Manchester.*

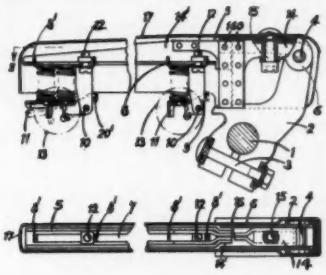
Apparatus for counting the filaments of a multifilament yarn comprises means for holding a yarn under constant strain (to give a constant tension per filament) means for progressively cutting the filaments, an electro-mechanical transducer sensitive to changes in tension in yarn, and amplifier means for receiving electric pulses from the transducer and feeding them to a pulse counter. The filaments may be counted by counting the pulses occurring at the transducer as each filament is cut. Preferably the means for holding the yarn under tension comprises a spaced-apart pair of bars each providing an edge over which the yarn is bent, such arrangement serving to assist in separation of the filaments.

829,396 Improved Drafting Mechanism

SKF KUGELLAGERFABRIKEN GESELLSCHAFT MIT BESCHRANKTER HAFTUNG, 52 *Schultestrasse, Schweinfurt am Main, Germany.*

Improved drafting mechanism of the type comprising a carrier arm pivotally mounted on a stationary bracket and which carries housings for twin top rolls and weighting means for the latter. Brackets 2 are secured by means of tightening bolts 3 at intervals on a supporting bar 1. Each of the brackets comprises, on an upward extending portion, a journal 4 on which the carrier and weighting arm, which consists of two component parts 6, 5, is received. The component 6, which is

pivoted on the bracket 2, may also be locked by means of a known locking device when down in its operating position. The front component 5 of the carrier arm consists of a support bent into a U-shape and having a central guide slot 7 for holders 8 which are separate units and which receive, on arms 9, saddle-shaped housings 11 for twin top rolls 13 which saddle-shaped housings are each pivoted about a bolt 10. The holders 8 are secured by means of tightening screws 12 in the slot



7, and an accurate parallel positioning of the top rolls is ensured by bent tongues 8^1 on the holders 8 which slide in slot 7. A section 14 of component 5, which section is U-shaped at its rear end, engages in the component 6 which is also bent into a U-shape. The component 6 is mounted on bracket 2, and it and the section 14 are joined together by a tightening screw 15. The section 14^1 of the component 5, which carries the holders 8, is connected to section 14 by frictionless means in such a manner, that the section 14^1, which reaches over the drafting field, is adapted for lateral winging about an axis which is upstanding in relation to the plane of the drafting field. These frictionless means consist of a flexible sheet-steel plate 16 held between sections 14 and 14^1 by rivets or screws 160. The components 5 and 6 of the carrier arm are covered by a common protective cover 17 which is held in position by the screw 15.

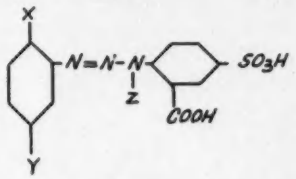
829,570 Printing Process

CIBA LTD., *Basle, Switzerland.*

A process for the production of neutrally developable prints, in which there is used a printing preparation containing coupling component of the manufacture of ice-colours, alkali in a quantity of preferably more than 2 mol, per mol of the coupling component used, and a liable diazoamino-compound of the general formula

$$-O_{mn}-1C_nH_{2n+1}$$

in which Y indicates a sulphonamide group which is preferably alkylated, Z is a low molecular, branched alkyl radical and X is a group of the composition



in which m and n are each a positive whole number of which the product is at most 2, in the absence of halogen-fatty acids or their salts.

829,645 Detection Device for Bast Fibre Slivers

D. FRASER AND SONS LTD., *Westburn Foundry, Arbroath, Scotland.*

A detection device for drawing frames for slivers of bast fibres fed from a sliver roll, consists of a pair of forwarding rollers located between the roll and the main feed rollers of the drawing frame and presenting a nip through which sliver passes to the feed rollers. The forwarding rollers are normally spaced apart by the sliver, being formed as electrical current conductors and being incorporated in an electrical circuit to and from the operating mechanism of the drawing frame, at least one of the forwarding rollers being insulated from the main frame of the drawing frame.

829,751 Improved Heald Frames

I. MARUYAMA, 41 *Higashi-2-cho, Nakano-cho, Sakai City, Osaka, Japan.*

A heald frame, includes a first rectangular frame having mounted thereon a second rectangular frame carrying healds. The first frame comprises two beams, disposed one opposite the other, with two stays connecting the beams, the second frame comprising two bars extending parallel to the beams and disposed one bar opposite the other bar, and two members, with which the healds and the stays are parallel, connecting the bars. The second frame is supported in relation to the first by portions of the second frame engaging in recesses on the first frame, there being four such recesses, two on one side of the first frame and two on that side of the first frame opposite the one side. Levers are provided, each of which is mounted adjacent a corresponding recess and movable between an associated operative position, in which the relevant lever prevents movement of the second frame out of the corresponding recess and away from the first frame, and an associated in-operative position, in which the relevant lever permits movement to occur. Spring means are arranged to maintain the respective levers in the operative positions.

829,835 Continuous Bleaching or Dyeing Cellulosic Fibres

SMITH AND NEPHEW TEXTILES LTD., *Glen Mills, Colne.*

Method for the continuous bleaching or dyeing of cellulosic fibres in sliver form comprises wetting a carded web with a solution of a wetting agent, mangling the web to give it a strong, flattened form impregnating the flattened web with a solution of a bleaching agent or dyestuff, and mangling the web to a predetermined liquor ratio. The web is then passed through a heater to raise its temperature to that requisite for bleaching or dyeing and plaited and piled in an accumulator and left for a sufficient time for bleaching or dyeing to be effected. The web is then subjected to an alkaline boil if the solution used was that of a bleaching agent, and washing and drying is then carried out after neutralisation if necessary.

830,235 Safety Device for Rag Tearing Machines, Etc.

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